DRAFT REPORT

SITE: Firestone-Albany
BREAK: 4.9
OTHER: ______

FEASIBILITY STUDY
FORMER FIRESTONE
TIRE & RUBBER
COMPANY FACILITY
ALBANY, GEORGIA

Prepared for
U.S. Environmental Protection Agency
Region IV
Atlanta, Georgia

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Revision 1

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0.0 EXECUTIVE SUMMARY

The former Firestone Tire & Rubber Co. facility (the site) in Albany, Georgia was a tire manufacturing facility in operation from 1968 to 1986. In October 1989, the facility was placed on the National Priorities List (NPL) as a result of environmental investigations conducted at the site. The placement on the NPL initiated actions by the United States Environmental Protection Agency (U.S. EPA) pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA).

A Remedial Investigation/Feasibility Study (RI/FS) has been conducted for the site pursuant to the Administrative Order on Consent executed between Bridgestone/Firestone, Inc. and the EPA on July 7, 1990, as amended by the modification to the Administrative Order on Consent signed by the EPA on August 6, 1991 and as subsequently amended in March 1992. The purposes of the RI/FS are to determine the nature and extent of contamination for all affected media at the site; assess the current and potential risks to public health and the environment; establish criteria for cleaning up the site; identify preliminary alternatives for remedial actions; and support technical and cost analysis of alternatives.

This FS Report is consistent with the current RI/FS Guidance Document (U.S. EPA, 1988c) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). It is based on the information presented in the June 1992 RI Report and the additional data obtained from a subsequent sampling event. The primary objectives of the FS are to:

- Identify, screen, and select remediation technologies and process options for each chemical to be remediated
- Assemble, evaluate, and screen remediation alternatives
- Conduct a detailed analysis of each of the retained alternatives

0.1 REMEDIATION GOALS AND LOCATIONS

Medium-specific remediation goals represent the final concentrations to be reached at the completion of remedial activities and have been established for groundwater and soil. Surface water and sediment were also evaluated during the RI, but are not included in the development of remediation goals because none of the chemical-specific cancer risks exceeded 1×10^{-6} or noncarcinogenic Hazard Indices exceeded the threshold comparison value of 1.0.

Remediation goals for groundwater were established using maximum contaminant levels (MCLs), nonzero maximum contaminant level goals (MCLGs), and results of the baseline risk assessment, as discussed in Section 3.0 and presented on Table 3-8. Considering the current and potential future use of the site, compliance with the remediation goals is appropriate for potentially usable groundwater located at and beyond the boundary of the current manufacturing area as defined in the baseline risk assessment.

Available groundwater data do not indicate chemical concentrations that warrant remediation in areas located outside the boundary of the manufacturing area. Volatile organic compound (VOC) concentrations above the remediation goals were only identified in the shallow (Residuum and Transition Zone) wells located within the current manufacturing area. Remedial action alternatives have been developed to address potential migration of these contaminants to locations at or beyond this area.

None of the baseline risk assessment results for the site soils indicate upper bound cancer risk levels or noncarcinogenic Hazard Indices that exceed acceptable levels. A few of the soil sampling results from the former OT-1 transformer area indicate concentrations of polychlorinated biphenyls (PCBs) that exceed the 10 milligrams per kilogram (mg/kg) action level established for the site on the basis of available U.S. EPA guidance (1990b) and the PCB Spill Cleanup Policy promulgated under the Toxic Substance Control Act (TSCA). The PCB Spill Cleanup Policy is not an ARAR for Superfund response actions. However, as a codified policy representing substantial scientific and technical evaluation, it has been considered in the development of cleanup goals for the site soil. Data indicate that the total volume of soil that exceeds the 10 mg/kg action level can be estimated at 20 cubic yards (cu yd) (30 tons).

0.2 GROUNDWATER REMEDIAL ACTION ALTERNATIVES

Remedial alternatives that prevent or minimize human exposure to all groundwater with contaminant concentrations that exceed the remediation goals were assembled. The assembled alternatives also provide protection of the environment against exceeding these goals in potentially usable groundwater located outside of the current manufacturing area. Four alternatives were retained for detailed evaluation. The retained groundwater alternatives are referred to as: Alternative A (No Action); Alternative B (Institutional Controls); Alternative C (Institutional Controls and Containment); and Alternative D (Institutional Controls, Pumping Wells, On-Site Treatment, and Discharge to Publicly Owned Treatment Works (POTW).

For Groundwater Alternative A, no remedial actions would be implemented. This alternative is required by the NCP and serves as a baseline against which the other alternatives are compared. Alternative B consists of institutional controls through deed restrictions in combination with groundwater monitoring. This alternative provides for the natural attenuation of contaminants to restore groundwater quality. Alternative C consists of institutional controls through deed restrictions and groundwater monitoring and containment using an asphalt cap. The cap would reduce surface water infiltration and retard subsequent migration of contaminants. Alternative D includes institutional controls through deed restrictions and groundwater monitoring, extraction of contaminated groundwater using pumping wells, on-site treatment using air stripping, and off-site discharge of the treated water to the local POTW.

0.3 SOIL REMEDIAL ACTION ALTERNATIVES

Remedial alternatives for soil were developed to treat the principal threats posed by the site, but vary the degree of treatment employed and the quantities and characteristics of the treatment residuals and untreated soil to be managed. Four alternatives were retained for detailed evaluation. The retained soil alternatives are referred to as: Alternative A (No Action); Alternative C (Institutional Controls and Containment);

Alternative D (Excavation and Off-Site Disposal); and Alternative E (Excavation, Solvent Extraction, and On/Off-Site Disposal).

For Soil Alternative A, no remedial actions would be implemented. This alternative is required by the NCP and serves as a baseline against which the other alternatives are compared. Alternative C consists of institutional controls through deed restrictions, a security fence, groundwater monitoring, and containment using an asphalt cap. The deed restrictions and security fence would reduce the possibility of ingestion or direct contact with the PCBs. The cap would reduce the potential for PCB migration, and the installation and sampling of a monitoring well would evaluate possible migration of PCBs into the groundwater. Alternative D consists of excavation of the contaminated soil and off-site disposal at a TSCA-permitted landfill. This alternative would effectively remove the soil with PCB concentrations exceeding the 10 mg/kg action level. Alternative E would include removing the soil with PCB concentrations exceeding 10 mg/kg, treating the soil using a solvent extraction process until the PCB concentration is less than 2 mg/kg, and placing the treated soil on site.

0.4 POTENTIAL COMBINATIONS OF ALTERNATIVES

The groundwater and soil alternatives can be combined to form the remedial action alternatives for mitigation of this site. The four groundwater alternatives and four soil alternatives form an array of ten potential alternatives. The total present worth of each of the ten alternatives is presented in Table 0-1. Any of the groundwater alternatives are compatible with any of the soil alternatives.

TABLE 0-1
TOTAL PRESENT WORTH OF SITE-WIDE ALTERNATIVES
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Site-Wide	Groundwater	Soil	Cost
1	A	A	$0
2	B	C	$457,708
3	B	D	$390,723
4	B	E	$549,326
5	C	C	$734,751
6	C	D	$667,766
7	C	E	$826,369
8	D	C	$2,002,204
9	D	D	$1,935,219
10	D	E	$2,093,822

Groundwater Alternatives

A: No Action
B: Institutional Controls
C: Institutional Controls and Containment
D: Institutional Controls, Pumping Wells, On-Site Treatment, and Discharge to POTW

Soil Alternatives

A: No Action
C: Institutional Controls and Containment
D: Excavation and Off-Site Disposal
E: Excavation, Solvent Extraction, and On/Off-site Disposal

1.0 INTRODUCTION

The former Firestone Tire & Rubber Company facility (the site) in Albany, Georgia was a tire manufacturing facility in operation from 1968 to 1986. In October 1989, the facility was placed on the NPL as a result of environmental investigations conducted at the site. The placement on the NPL initiated actions by the U.S. EPA pursuant to CERCLA, as amended by SARA.

A RI/FS has been conducted for the site pursuant to the Administrative Order on Consent executed between Bridgestone/Firestone, Inc. and the U.S. EPA on July 7, 1990, as amended by the modification to the Administrative Order on Consent signed by the U.S. EPA on August 6, 1991. The purposes of the RI/FS are to determine the nature and extent of contamination for all affected media at the site; assess the current and potential risks to public health and the environment; establish criteria for cleaning up the site; identify preliminary alternatives for remedial actions; and support technical and cost analysis of alternatives. The RI/FS process does not attempt to achieve the unattainable goal of removing all uncertainty, but enables the collection of sufficient information to support an informed risk management decision regarding appropriate remediation action activities at a given site. The preferred remedial action at a site should be a timely, cost-effective, and implementable remedial alternative that is protective of human health and the environment (U.S. EPA, 1988c).

1.1 PURPOSE AND ORGANIZATION OF REPORT

This FS report is based on the information presented in the June 1992 RI Report and the additional data obtained from a subsequent sampling event. The methodology used to prepare the FS report is in accordance with U.S. EPA's "RI/FS Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA" (U.S. EPA, 1988c), which is referred to as the "RI/FS Guidance Document" throughout the remainder of the report. The primary objectives of this FS report are to:

- Identify, screen, and select remediation technologies and process options for each chemical to be remediated.

- Assemble, evaluate, and screen remediation alternatives.

- Conduct a detailed analysis of each of the retained remediation alternatives.

This report is divided into ten sections. Information presented in each section is summarized as follows.

- Section 0.0 presents an executive summary, which is a brief overview of the report identifying key concepts, information, and conclusions.

- Section 1.0 provides an introduction to the report by describing the purpose and organization of the report and background information regarding the site.

- Section 2.0 summarizes the findings of the RI and contains general information on the site conditions.

- Section 3.0 presents information used for the technology screening and alternatives development, including remediation goals and definition of the remedial action areas and volumes.

- Section 4.0 describes general response actions and identifies and screens candidate technologies and process options.

- Section 5.0 describes the development and screening of remedial alternatives that may be applicable to the site using the technologies and process options retained after the screening in Section 4.0.

- Sections 6.0 and 7.0 present detailed evaluations of the alternatives for groundwater and soil, respectively.

- Section 8.0 provides comparative analyses and potential combinations of the alternatives for groundwater and soil.

- Section 9.0 lists the references cited in the report.

1.2 SITE BACKGROUND

A general site description of the site history is provided in this section.

1.2.1 Site Description

The site encompasses 329.2 acres, including a 1,840,000 square foot (ft^2) building, located at 3300 Sylvester Road in Albany, Georgia. The city of Albany is located in Dougherty County in the southwest portion of Georgia. The site is located east of the city of Albany (Figure 1-1).

Some of the prominent site features include the manufacturing building, courtyard area, former burn pit, storm water drainage ditches, storm water detention pond, relatively undisturbed, heavily vegetated southern portion of the site, and a relatively undisturbed grassy area west of the manufacturing building (Figure 1-2).

Properties surrounding the site include:

- Mixed commercial, residential and agricultural properties to the east

- Sylvester Road (Route 82) and residential and commercial buildings to the north

- Mixed commercial, institutional and agricultural properties to the west

- Seaboard Coastline railroad tracks and U.S. Marine Corps Logistics Base to the south

Along the eastern property line lies vacant land, which was formerly used for agricultural purposes. Immediately to the north of the site is Sylvester Road, a four-lane highway (U.S. Route 82). North of Sylvester Road are eight mobile home parks and three commercial retail sites, including a flea market and a gas station. Along the western property line are a church, a tree farm and vacant land. The southern property line is along the Seaboard Coastline railroad tracks. A railroad spur along the east side of the site, which serves the facility's shipping and receiving operations, is connected to the Seaboard Coastline railroad at the southeast corner of the site. To the south of the site, beyond the railroad right-of-way, lies the U.S. Marine Corps Logistics Base. The U.S. Marine Corps Logistics Base is also on the NPL.

1.2.2 Site History

Construction of the manufacturing complex commenced in 1967. Bridgestone/Firestone, Inc. manufactured pneumatic tires at the facility from 1968 to 1986. Bridgestone/Firestone, Inc. ceased operations at the site in 1986. Except for remedial activities, the site remained inactive until March 1990, at which time Cooper Tire Company purchased the Bridgestone/Firestone, Inc. leasehold and began renovations for future operations. The Cooper Tire Company began production operations in November 1991.

Various chemicals associated with the tire manufacturing process or were contained on site. Chemicals that may have been used during manufacturing or maintenance activities, including degradation by-products of chemicals used during manufacturing or maintenance activities, are listed below:

- Benzene
- 1,1,1-Trichloroethane (1,1,1-TCA)
- 1,1-Dichloroethylene (1,1-DCE)
- 1,2-Dichloroethane (1,2-DCA)
- Toluene
- Zinc

Polychlorinated biphenyl (PCB) fluids were associated with the former on-site transformers located inside and outside the manufacturing building. Two main source areas were identified at the site: the courtyard area and burn pit/buried drum areas.

Both areas are within the manufacturing area as defined in the baseline risk assessment. The RI contains a complete historical description of the courtyard and burn pit/buried drum areas. The two areas are summarized below.

The courtyard area, located on the eastern side of the manufacturing building, was used for shipping and material handling operations (Figure 1-3). Drummed chemicals were handled and transferred from delivery vehicles at the process oil and solvent unloading stations within the courtyard. Process oil and solvents were stored in underground storage tanks (USTs). Gasoline was also stored in USTs. Waste fuel oil and spent solvents were temporarily stored at a Resource Conservation and Recovery Act (RCRA) permitted hazardous waste storage area east of the courtyard. Primary plant transformers containing PCB-containing fluids were located within the courtyard on seven concrete pads. The USTs and primary plant transformers were removed and the hazardous waste storage area was closed. Currently, there is a gasoline and diesel fuel station and above-ground fuel storage tanks within the courtyard area. The filling station is currently used in the operations of the manufacturing facility.

The former burn pit/buried drum area is located near the intersection of the east drainage ditch and the storm water detention pond (Figure 1-2). The burn pit area, which is approximately 3,000 ft^2 in area, was constructed to collect the run-off from a 6,000 gallon (gal) spill of anti-oxidant (Santoflex 13) in 1980. The fluid was later pumped from the pit and placed in 55-gal drums. This material and approximately 65 partially filled drums (3,500 to 4,000 gal) of liquid waste cement were then burned as a fire training exercise. Directly adjacent to the burn pit is an area which was apparently used as a dump site for 55-gal drums containing waste rubber cement and Banbury sludge. Drums were excavated from this dump area and disposed at a licensed off-site landfill. Details of the remedial activities are described in Section 1.2.3.

The manufacturing building is served by city water and sewer system. Storm and noncontact process waters were discharged through drainage ditches to a storm water detention pond. The overflow from the pond discharges through a small concrete weir and then flows through storm water pipes, ditches and canals and ultimately discharges to the Flint River. This outfall was permitted and regulated during operation of the facility by The Firestone Tire & Rubber Company.

1.2.3 Previous Investigations and Remedial Actions

In 1985, Bridgestone/Firestone, Inc. voluntarily initiated an assessment of the presence of chemicals in the soil, groundwater, surface water, and sediments at the facility as a part of the facility closure. Based on the results of this assessment, subsequent investigative and remedial activities were performed. A summary of the investigative and remedial activities were presented in a Scoping Document (WCC, 1990) and are briefly discussed in this subsection.

Site characterization was also performed in the course of the ownership transfer of the facility to the Cooper Tire Company. In 1989, Environmental Mitigation Group, Inc. (EMG) was directed by the Cooper Tire Company to conduct an independent environmental site assessment of the closed Firestone facility. The results of the site assessment were discussed in the Scoping Document.

An overview of the remedial activities that were undertaken in response to the investigations is presented below.

1.2.3.1 <u>Overview</u>

Remedial actions and field investigations conducted prior to June 1991 at the site had principally consisted of the following activities:

1. WCC and EMG site assessments;

2. General site cleanup, including the identification of miscellaneous soil and debris piles located on the site, chemical analyses of these piles, and removal and disposal of piles that displayed contamination;

3. Investigate the extent of PCB transformer leaks in the building interior, removal of the transformers, remediation of the areas surrounding the transformers;

4. Investigate the extent of PCB transformer leaks on the building roof, removal of the transformers and roof materials contaminated with PCBs;

5. Investigate the extent of PCB transformer leaks in the courtyard, removal of the transformers and concrete pads; and remediation of soils surrounding the former transformers;

6. Install monitoring wells in the Residuum soils and the Ocala Limestone of the Upper Floridan Aquifer;

7. Investigate the courtyard through exploratory soil borings and test pits to determine if the soils in the courtyard;

8. Remove USTs;

9. Investigate the burn pit/buried drum area, excavate the burn pit area, remove and dispose drums, contaminated soils and water, and confirmational sampling of the burn pit to determine the adequacy of clean-up;

10. Perform an electromagnetic surveys to identify areas of potential subsurface drum disposal, and;

11. Sample surface water and sediments in the storm water detention pond and the drainage ditches that flow into the pond.

1.2.3.2 General Site Cleanup

A general site cleanup was conducted to remove rubbish, debris, and a mound of soil material from the southern portion of the property. Approximately 441 cu yd of rubbish and debris and 105 cu yd of soil were transported to the Oxford Solid Waste Landfill (Oxford) in Albany, Georgia during these cleanup activities. Empty 5-gal containers and a few 55-gal drums were disposed at Chemical Waste Management Inc.'s Treatment Facility (CWM) in Emelle, Alabama.

1.2.3.3 PCB Evaluation/Remediation Program

Former electrical transformers located inside the manufacturing building, outside the building, and on the roof were evaluated for PCB spills. Wipe samples, roofing material samples, soil samples, storm water samples, and concrete samples were collected. Based on the results of the evaluation program, Bridgestone/Firestone, Inc. retained OHM Corporation (OHM) to clean the former transformer locations inside of the building. The Toxic Substance Control Act (TSCA) derived target cleanup level was 10 micrograms per 100 square centimeters (10 $\mu g/100\ cm^2$) or less. All transformer areas were cleaned by washing with a trisodium phosphate (TSP) solution. In some areas, concrete had to be removed by shot-blasting or chipping. Other miscellaneous PCB locations within the plant exceeding the target cleanup level have been remediated.

Outside transformer pads which formerly supported PCB transformers, were removed from the site and disposed at the Oxford landfill. Soil located in the vicinity of these pads was found to contain PCBs at concentrations greater than the target cleanup level of 10 mg/kg. The soil around the former transformer pads was excavated and disposed either at CWM or the Oxford landfill.

PCB transformers were also located on the plant roof in seven areas. Removal and disposal of PCB-contaminated concrete, roofing material, and metal deck; cleaning of structural steel; and the removal and/or cleaning of various electrical/mechanical services and the concrete floor for all areas.

1.2.3.4 Remediation of Former Burn Pit/Buried Drum Area

Contaminated soil and an estimated total of 160 drums, containing various amounts of materials characteristic of rubber cement and Banbury sludge, were removed from the former burn pit/buried drum area. After all drums were removed, excavation was continued until confirmatory sidewall and bottom samples indicated no presence of volatile organic compounds or until the bottom of the excavation was below the water table. After completion of the excavation and confirmatory sampling activities, provisions for future extraction of contaminated groundwater, if required, were made by installing a sump and backfilling the excavation with crushed limestone gravel, which was overlain by a clay cap.

1.2.3.5 Geophysical Investigation

Test pits were dug and terrain conductivity surveys were performed in suspect areas to investigate for the presence of additional drum and/or waste burial areas. Buried drums or waste materials were not identified from these activities.

1.2.3.6 Soil Investigation

A total of 27 shallow (i.e., depth ≤ 5 feet (ft)) soil borings and 38 exploratory (i.e., depth > 5 ft) borings were drilled into the Residuum soils across the site. Soil samples obtained from these borings were field classified and screened for volatile organic vapors using headspace analysis with a photoionization detector. Soil samples were analyzed for metals, PCBs, and VOCs. The soil sampling data indicated two areas of potential environmental concern: a gasoline tank area and the primary plant transformers. Bridgestone/Firestone, Inc. undertook preventative responses to those concerns. Even though the site assessment did not suggest any tank integrity problems, Bridgestone/Firestone, Inc. removed and disposed of all USTs. Post-excavation soil analyses verified that no contaminated soil remained in the tank pit area. Soil samples in the vicinity of the plant transformers contained PCBs in excess of 10 mg/kg. Soil in the transformer area was excavated and disposed in accordance with applicable regulations. Post-removal soil sampling in the remediated area indicated less than 10 mg/kg PCBs.

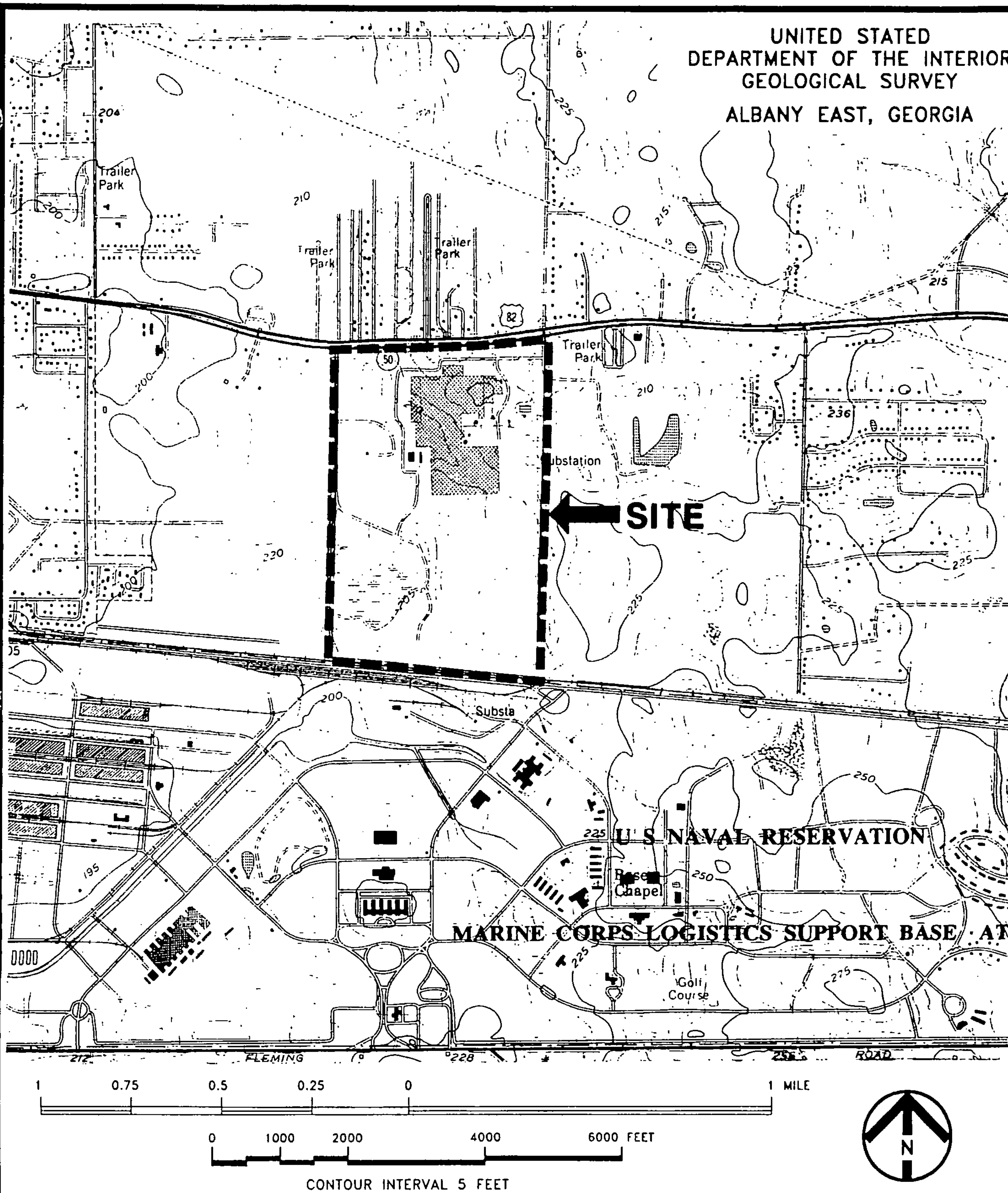
1.2.3.7 Groundwater Investigation

A total of 35 groundwater wells were installed at the site prior to the RI. Twenty-seven of the wells were screened to sample groundwater in the Residuum or the weathered horizon of the Ocala Limestone Formation. Four wells were constructed to sample groundwater from the more competent rock of the Upper Ocala Limestone. Two production wells and two observation wells originally installed to service the former

Firestone facility's production needs were developed in the productive zone of the Lower Ocala.

In addition to the monitoring well installation program, a groundwater extraction system was designed and constructed in the courtyard of the facility. One 6-inch (in.) diameter well (PTW-1), consisting of 65 ft of PVC screen (0.015-in. slot) and 20 ft of PVC riser, was installed in the courtyard on February 23, 1990. This well was screened both in the Residuum soil and partially into the weathered Upper Ocala Limestone. The well was installed in the area where groundwater samples had historically shown the highest concentrations of chlorinated compounds. Based on the recovery rate and hydraulic conductivity that was established for the water-bearing interval of the extraction well, a pneumatic pumping system was chosen as the most efficient means of groundwater extraction from this well. Operation of the system began on July 10, 1990 and operated until June 17, 1991, when the system was temporarily shut down. Measurements taken during operation indicated an extraction rate of approximately 0.1 gallons per minute (gpm). The extracted groundwater was accumulated in a 30,000-gal capacity fiberglass tank located approximately 150 ft from the well. Approximately 35,000 gal of accumulated water were periodically drained from the tank and either transported off site for treatment and disposal or discharged to the local wastewater treatment plant under a temporary permit. Operation resumed in December, 1991 after obtaining the necessary permits required for additional discharge to the local wastewater treatment plant. Current operations include pumping from MW-1-3 using a pneumatic pump. MW-1-3 historically has had the highest concentrations of chlorinated compounds.

Figures



GENERAL LOCATION MAP

FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

DRAWN BY: REM	CHECKED BY: MJM	PROJECT NUMBER: 90C6116	DATE: 7-29-92	FIGURE NO: 1-1

Woodward-Clyde Consultants

2.0
REMEDIAL INVESTIGATION SUMMARY

An understanding of the site conditions is necessary to evaluate potential remedial alternatives for the site. This section provides a brief summary of the existing conditions identified during the RI. A more detailed presentation is provided in the RI Report (WCC, 1992b).

2.1 GEOLOGIC CHARACTERIZATION

2.1.1 Regional Geology

The regional geology is comprised of three units of interest: the Residuum; the Ocala Limestone; and the Lisbon Formation. The Residuum is the uppermost unit and is a sandy and clayey soil unit derived from weathering of the underlying Ocala Limestone. The Ocala Limestone, of early Eocene age, lies below the Residuum. The thickness of the Ocala Limestone generally increases to the southeast across Dougherty County, with thicknesses ranging from approximately 25 to 270 ft (Hicks et al., 1987). The Upper Ocala Limestone shows weathering in the upper portion and grades to a hard, brittle limestone with depth. Well-developed solution-enlarged joints, bedding planes, and fractures have been identified in the Lower Ocala to form secondary permeability features. The top of the Ocala has an irregular surface. Isolated highs and lows were formed by differential weathering of the surface and by solution cavity collapses. The Ocala Limestone is underlain by the middle Eocene age Lisbon Formation, which is generally considered a confining formation separating the Ocala Limestone (Floridan Aquifer) from the underlying Tallahatta Aquifer. The lithology of the Lisbon Formation varies, but generally consists of brownish-gray to yellow, argillaceous, fossiliferous, sandy, glauconitic, dense limestone containing thinly interlayered calcareous sandstone and clay lenses (Hicks et al., 1987).

2.1.2 Site Geology

The site geology described in the RI Report is consistent with the regional geology. Drilling performed during the RI activities extended to a maximum depth of 190 ft and was terminated within the Ocala Limestone. The Residuum composition varies across the site and can generally be described as sandy clay to clayey sand. The Residuum thickness averages approximately 50 ft across the site, but has been observed to vary greatly over relatively short distances. The Ocala Limestone is typically white to tan in color and grades from a highly weathered, fine to coarse grained, fossiliferous, soft limestone into a less weathered, finer grained, less fossiliferous, more indurated limestone at depths ranging from approximately 130 to 150 ft below ground surface (bgs). The soft, more weathered limestone is referred to as the Upper Ocala and the more indurated limestone is considered to represent the Lower Ocala. Relatively significant void spaces (4 to 10-ft thick) were identified in the Lower Ocala just below the contact with the Upper Ocala Limestone.

2.2 HYDROGEOLOGIC CHARACTERIZATION

2.2.1 Regional Hydrogeology

Regionally, groundwater from certain units is used extensively for agricultural irrigation, industrial, municipal, and domestic purposes. The sources of this groundwater supply are four principal aquifers; in descending order, these aquifers are: the Floridan, Tallahatta, Clayton, and Providence Sand Aquifers. The municipal water supply is almost entirely derived from the lower three aquifers. The Floridan Aquifer is contained primarily within the Ocala Limestone throughout Dougherty County and is a primary source of water for irrigation, industrial, and rural domestic use. The Floridan Aquifer is confined below by lower permeability zones in the Lisbon Formation and is semiconfined above by the leaky Residuum and by lower permeability zones in the Upper Ocala.

Regional groundwater studies of the Floridan Aquifer in the northwest Dougherty Plain have measured a transmissivity (T) of about 2,000 ft^2/day, and wells in the productive zones can produce about 500 gpm (Hicks et al., 1987). The permeable zone is believed to have resulted from dissolution of the limestone by circulating groundwater. Major solution conduits in the limestone may account for only a small part of the cross sectional flow area, but control a major part of the groundwater flow (Hayes, 1983).

A review of groundwater wells within a 3-mile radius of the site was conducted during the RI. Inquiries were made to local, state, and federal agencies to obtain information about the existence of any municipal, industrial or private wells within the site vicinity. A total of 70 wells were identified within a 3-mile radius of the site. Wells depths range from 105 to 997 ft bgs.

A residential well survey was also conducted to identify wells in residential areas within adjacent to the site. A total of 26 wells were identified by this survey. The majority of wells are clustered around two general areas: along Branch, Holton and Sylvester roads north/northeast of the site, and along the lower portion of Pinson Road (including Averitt Road and Gurr Drive) southwest of the site. Use of the 26 residential wells varies. Three of the 26 wells are not in use, 3 are used for nonpotable purposes (e.g., watering lawn) and the remaining 20 are used primarily as a water supply. Three of the 20 residences which have a well used primarily as a water supply also are connected to the municipal water supply. One well provides drinking water for a trailer park located east of the site (Cabana Park) which contains approximately 17 units. Residential well depths are generally greater than 100 ft bgs.

2.2.2 Site Hydrogeology

Three separate hydrostratigraphic units, designated as the Residuum, the Upper Ocala Limestone, and the Lower Ocala Limestone, were identified at the site during the RI. Some of the Upper Ocala Limestone wells contain screen/sand pack interval that straddle both the Residuum and the Upper Ocala Limestone. This contact is referred to as the "Transition Zone".

In general, the RI verified that groundwater flow directions at the site are consistent with regional flow conditions. Strong downward vertical gradients were found to exist in the two upper hydrostratigraphic units (Residuum and Upper Ocala Limestone). These units are a recharge source to the underlying Lower Ocala Limestone. The Lower Ocala Limestone is also recharged by upgradient groundwater flow originating from recharge areas east and north of the site. The major horizontal component of groundwater flow coincides with regional flow in the Lower Ocala directions and is to the west-southwest.

The horizontal hydraulic conductivity of the Residuum ranged from 1 x 10^{-4} to 1 x 10^{-6} cm/sec, with an average of 4 x 10^{-5} cm/sec. Horizontal movement of groundwater within the Residuum is limited by the lack of continuous water-bearing zones and low horizontal hydraulic conductivity. The Residuum has been observed to possess strong downward vertical gradients. Infiltration throughout the Residuum is variable. This may be a result of vertical relict fissures.

The horizontal hydraulic conductivity of the Upper Ocala Limestone was evaluated during the RI, and the testing program showed hydraulic heterogeneity. The calculated hydraulic conductivity values for the aquifer test program was around 1 x 10^{-5} cm/sec. However, hydraulic conductivity values for the Upper Ocala, based on double-packer tests performed approximately 135 ft from the aquifer test pumping well, ranged from approximately 2 x 10^{-4} to 3 x 10^{-3} cm/sec.

A vertical flow gradient in the Upper Ocala Limestone ranged from approximately 0.03 to 0.10 ft/ft. These vertical gradients are similar to those measured regionally in the Floridan Aquifer (Hicks et al., 1987).

An average horizontal gradient of approximately 0.002 ft/ft was calculated for the Upper Ocala Limestone. The horizontal groundwater flow directions are somewhat variable and do not always correspond with the regional flow pattern. West-southwest flow directions are evident in the northeast corner of the site, but are reversed in the southwest corner. Local variations in groundwater flow directions that are not consistent with regional directions are common in the upper portions of the Ocala Limestone (Hicks et al., 1987).

Data obtained during the RI indicated that the hydraulic conductivity of the Lower Ocala Limestone at the site is on the order of 3 x 10^{-1} cm/sec. The general southwest flow direction, corresponds with the regional flow (Hicks et al., 1987) for the Ocala Limestone in the vicinity of the site. A horizontal gradient of approximately 0.001 ft/ft was calculated for the wells located in the southwest portion of the site.

2.3 CHEMICAL CHARACTERIZATION

Many of the chemicals identified during investigative activities are suspected to have originated from the chemical materials utilized during past manufacturing activities. These source materials include solvents, gasoline, fuel oils, former PCB transformers, and waste materials.

Organic chemicals were detected in surface soils, subsurface soils, sediments, surface water, and groundwater. The presence of many of these organic chemicals was associated with suspected source areas. Analytical data that were presented in the final RI Report (WCC, 1992b) are summarized in the following subsections. Results of the recent sampling for inorganic chemicals conducted in June 1992 are discussed in Section 3.0.

2.3.1 Surface Water Data

Surface water quality data indicate that organic chemicals are generally present in few samples at low, often estimated, concentrations in the site water bodies, drainage ditches, and the former storm water detention pond. Detected chemicals include 1,1,1-TCA, 1,1-DCA, 1-methyl-2-pentanone, acetone, carbon disulfide, and methylene chloride. Inorganic chemicals were detected and are naturally occurring.

2.3.2 Sediment Data

Sediment sampling results from the same water bodies detected the infrequent presence of low, often estimated, concentrations of organic chemicals. Metals detected in sediment samples were usually at concentrations similar to metal concentrations in soil.

2.3.3 Soil Data

Organic chemicals were more frequently detected at somewhat higher concentrations in subsurface soils compared with surface soils. The detected organic chemicals include VOCs, which were generally at low concentrations (less than 100 μg/kg). PCBs were detected in surface and subsurface soils near the former transformer locations in the courtyard. Most concentrations of PCBs were below 10 mg/kg; however, some isolated high concentrations (up to 230 mg/kg) were found in samples collected from depths of 4 to 5.5 ft.

Generally, the only inorganic chemicals measured in surface and subsurface soils above site-specific background concentrations are antimony and zinc. When national concentration ranges of these metals in soil are examined, the concentrations detected on site are not dissimilar (Dragun, 1988). Nonetheless, because the concentrations of these metals exceed site-specific background levels, they were included as COCs for the purpose of assessing site risks. The conclusion of the risk assessment is that neither of these metals contribute to unacceptable health risks or hazards. Therefore, antimony and zinc do not need to be addressed in the remedial alternatives presented in this document on the basis of risk.

2.3.4 Groundwater Data

A review of groundwater quality data in all hydrostratigraphic units suggests that the lateral extent of contaminants is limited to areas that are near suspected source areas. Although inorganic compounds (metals) were detected in groundwater, many are generally comparable to site background concentrations. The metals most frequently measured above background concentrations included aluminum, beryllium, cadmium, cobalt, copper, iron, lead, manganese, magnesium, and vanadium. The higher concentrations of these metals were usually found in Residuum and Upper Ocala/Transition Zone wells. Some of these metals may have been above background concentrations as a result of the different depths between site and background wells.

Organic chemicals detected in groundwater tend to be limited to the courtyard and burn pit areas. Organic contaminants detected in the Residuum groundwater included 1,1,1-TCA and associated products (1,1-DCA and 1,1-DCE), acetone, benzene, and carbon disulfide.

Groundwater within the Transition Zone and the Upper Ocala wells contained the highest concentrations of organic contaminants. Chemicals frequently detected in this area were 1,1,1-TCA, 1,1-DCA, 1,1-DCE, acetone, benzene, carbon disulfide, ethyl benzene, toluene and xylenes.

Organic chemicals were infrequently detected within the Lower Ocala Limestone groundwater. Chemicals detected include 1,1-DCA, 1,1-DCE, acetone, carbon disulfide, toluene and DEHP. In addition, several trihalomethanes were detected (chloroform, dibromochloromethane, and dibromodichloromethane) as well as tetrachloroethylene (PCE), and trichloroethylene (TCE). Reportedly, the trihalomethanes, PCE, and TCE were not used at the facility and their source is unknown.

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Evaluation of the vertical distribution of organic and inorganic chemicals in each of the hydrostratigraphic units indicates that the most frequently detected and highest concentration of the chemicals were measured within the Transition Zone. The Residuum has the second highest concentrations of most organic chemicals.

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The higher concentrations of organic and inorganic chemicals measured at monitoring wells within the Transition Zone is most likely a result of Residuum water quality and is not representative of the Upper Ocala Limestone as a whole unit. Monitoring wells screened within the Upper Ocala Limestone, but below the Transition Zone do not show similar concentrations of organics. In addition, the presence of metals and the baseline inorganic water quality of the Transition Zone is more characteristic of water from the Residuum than from the Upper Ocala.

2.4 CHEMICAL MIGRATION

The primary factors affecting chemical migration and transport in the groundwater system are:

- Strong downward groundwater flow directions
- Mixing and attenuation within the groundwater systems at depth

The presence of downward vertical hydraulic gradients in the Residuum and Upper Ocala has limited the lateral spread of contaminants of concern within each hydrostratigraphic unit. The most frequently detected and highest concentration of chemicals were measured in areas near suspect sources of the same chemicals.

The downward transport of the chemicals results in mixing and attenuation within the deeper "cleaner" groundwater. The relatively small amount of groundwater flow and chemical loading from source areas within the Residuum and Transition Zone is mixed with a larger amount of groundwater flowing through the Upper Ocala Limestone (80 to 120 ft thick); the result is that the source chemical loading appears to be significantly dispersed. In-situ hydrolysis of some organics may also be occurring. Attenuation is also supported by the general lack of detectable levels of organic contaminants of concern in the deeper portions of the Upper Ocala Limestone and Lower Ocala Limestone at distances below and adjacent to source areas.

2.5 ASSESSMENT OF POTENTIAL HUMAN HEALTH AND ENVIRONMENTAL RISKS

A baseline risk assessment was performed to examine the potential impacts upon human health and the environment posed by contaminants of concern detected in site media. Human health cancer risks and noncarcinogenic health hazards were calculated following U.S. EPA risk assessment guidance, assessing reasonable maximum exposures to workers, trespassers, potential off-site residents at the facility border, and potential future residents on the site. Potential environmental impacts were examined by comparing site media concentrations with effect-based concentrations limits or by examining the chemical, physical, and toxicological properties of the chemicals.

Overall, the assessment indicated that unacceptable health hazards and risks are not posed to humans currently having access to the site. The overall upper bound cancer risk for reasonable maximum exposures of current workers at the site are within the acceptable risk range (1×10^{-4} to 1×10^{-6}), and the noncarcinogenic Hazard Index is below the comparison Hazard Index threshold value of 1.0. The overall upper bound cancer risks for reasonable maximum exposures of trespassers, both youths and adults, are at or below the lower end of the risk range (1×10^{-6}), and the noncarcinogenic Hazard Indices are below the comparison Hazard Index threshold value of 1.0. The overall upper bound cancer risks and noncarcinogenic health hazard estimates for potential future residents that reside at the western site border and depend exclusively on local groundwater from the Upper Ocala/Transition Zone are also within or below acceptable levels. In addition to representing exposures to receptors currently having access to the site, these scenarios also represent potential future use of the site, as well.

The baseline risk assessment also evaluated the health impacts associated with potential future residential development of the manufacturing area and southern portions of the site. When residents (children and adults) are assumed to reside on the site property itself and depend exclusively on local groundwater from the Upper Ocala/Transition Zone as a potable water source, both upper bound cancer risks (greater than 1×10^{-4}) and noncarcinogenic health hazard estimates (greater than 1.0) exceed acceptable levels. In all cases, unacceptable risks and hazards were a result of groundwater ingestion and inhalation of volatile groundwater chemicals during showering. However, it is not likely that if residential conversion were to occur, local shallow groundwater would be used as the primary water supply, because connections to the municipal system already exist on the site and in surrounding areas, and the local shallow water-bearing zone does not produce adequate volumes of water.

In general, adverse impacts to aquatic, avian, and mammalian environmental receptors are unlikely. Surface water and sediment chemical concentrations are generally below comparison values, and concentrations of chemicals in soils were unlikely to pose a significant food chain impact under current site conditions. Although some isolated high concentrations of zinc and chromium were detected in sediments, the lack of sustained bodies of water and, therefore, the lack of widespread aquatic receptors, suggests that the impact of these concentrations is likely to be limited.

3.0 BASIS OF TECHNOLOGY SCREENING AND ALTERNATIVES DEVELOPMENT

The development and screening of remedial action alternatives is a multi-step process. First, remediation goals are developed to protect human health and the environment or to attain compliance with applicable or relevant and appropriate requirements (ARARs). Second, general response actions, representing a wide range of waste management options, are developed to satisfy the remediation goals. Specific remedial alternative actions are then developed from the list of waste management options. Finally, an analysis of the alternatives is performed to determine feasible remedial actions.

This section considers the chemicals identified on site during the RI that need to be addressed in the remedial actions for the site. These chemicals will be evaluated for the potential ARARs and potential risk-based remediation goals. Medium-specific remediation goals and remedial action areas and volumes are also presented. Potential remedial technologies, process options, and alternatives are developed and screened in Sections 4.0 through 8.0.

3.1 POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Section 121(d) of CERCLA, as amended by SARA, states that any remedial action selected for a site must attain, at a minimum, a degree of cleanup that ensures protection of human health and the environment. In addition, a level or standard of control under any federal or state environmental law that meets legally "ARARs" must be attained for any hazardous substance, contaminant or pollutant remaining on-site at the completion of remedial actions.

The requirements of federal and state laws are identified and applied to remedial actions as ARARs using the approach outlined in the U.S. EPA's *CERCLA Compliance with Other Laws Manual (Interim Final) Part I* (U.S. EPA, 1988a) and *Part II: Clean Air Act and Other Environmental Statutes and State Requirements* (U.S. EPA, 1989). Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant or contaminant, remedial action, location, or other circumstances at a CERCLA site. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that are not directly applicable to a hazardous substance, pollutant or contaminant, remedial action, location, or other circumstances at a CERCLA site but address problems or situations sufficiently similar to those encountered at the CERCLA site, and their use is well suited to the particular site. The judgement of the relevance and appropriateness of a requirement is based on several factors, including the characteristics of the remedial action, the substances in question, or the physical nature of the site.

There are 3 types of ARARs used to develop remedial actions: 1) chemical-specific, 2) action-specific, and 3) location-specific. The chemical-specific ARARs are health or risk-based concentration limits which may be used to designate an acceptable cleanup or discharge level. ARARs that are action-specific establish controls on the remedial activities as part of the remedial solution. The location-specific ARARs set limitations on activities due to specific site characteristics, such as wetlands, flood plains, or historical sites.

3.1.1 Chemical-Specific ARARs

Chemical-specific ARARs, as defined by the U.S. EPA (1988a), set numerical values that are considered protective of human health and the environment for the contaminants of concern at a site or that indicate an acceptable level of discharge occurs as part of remedial actions. These levels are usually health-based or risk-based values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values.

Table 3-1 provides a complete list of potential chemical-specific ARARs. Federal regulations that have been adopted under the Safe Drinking Water Act (SDWA), the Clean Water Act (CWA), The Clean Air Act (CAA), RCRA, and TSCA contain potential chemical-specific ARARs for the site. The Georgia SDWA, Water Quality

Control Act, Air Control Rules, and Hazardous Waste Management Rules are similar to the corresponding federal regulations and require compliance when more stringent than federal regulations. The Georgia Underground Storage Tank (UST) Act and the City of Albany Sewerage Ordinance also provide potential chemical-specific ARARs for the site.

3.1.1.1 Considerations for Remediation Goals

Numerical values that have been adopted under the federal and state SDWAs must be examined when establishing remediation goals for existing or potential drinking water sources. The specific numerical values consist of MCL and MCLGs. MCLs have been adopted under the SDWAs as enforceable standards for public drinking water systems. MCLGs are nonenforceable health goals for public drinking water systems and are set at levels that would result in no known or anticipated adverse health effects with an adequate margin of safety. According to the NCP, MCLs and nonzero MCLGs are relevant and appropriate for groundwater that may be used as a source of drinking water. MCLs and MCLGs for the site-specific COCs that were identified in the RI Report (WCC, 1992b) for the site groundwater are listed in Table 3-2. Numerical values provided by the Georgia UST Act are equal to the MCLs.

The only chemical-specific ARAR that provides a numerical value that can be used to establish cleanup level goals for the site soils is the Georgia UST Act. For the site-specific COCs, this act requires remediation of soil contamination that exceeds 20 mg/kg total benzene, ethylbenzene, toluene, and xylenes (BETX). However, this value would only be considered an ARAR for the former gasoline UST area located in the facility's courtyard. Action levels provided in U.S. EPA's *Guidance on Remedial Actions for Superfund Sites with PCB Contamination* (U.S. EPA, 1990b) and in the PCB Spill Cleanup Policy promulgated under TSCA (40 CFR 761.125) may be used as guidance to establish remediation goals for PCBs, as outlined in Section 3.1.1.4, but are not included as potential ARARs.

3.1.1.2 Additional Considerations

Chemical-specific ARARs must be reviewed in relation to possible discharge of chemicals to the ambient environment during remediation. Potential chemical-specific ARARs for discharge of extracted groundwater to surface water or the local POTW have been adopted under the federal and state SDWAs, the federal CWA, the Georgia Water Quality Control Act, and the City of Albany Sewerage Ordinance. Chemical numerical values that have been established under these potential ARARs for the COCs identified in the RI Report for the site groundwater are listed in Table 3-3. Additional chemical-specific ARARs that may be used to regulate discharge to the ambient environment during remedial actions are included in Table 3-1. These potential ARARs have been adopted under the federal RCRA, CAA, and TSCA, and the Georgia Air Quality Control Rules and Hazardous Waste Management Rules.

3.1.2 Action-Specific ARARs

Action-specific ARARs defined by the U.S. EPA (1988a) are usually technology-based or activity-based requirements or limitations on actions taken with respect to hazardous waste remediation. These requirements are determined by the particular remedial activities that are selected to accomplish remediation goals. The action-specific requirements do not determine the remedial alternative; they indicate the way in which the selected alternative must be implemented to establish performance levels, actions, or technologies, as well as specific levels for discharged or residual contaminants. Potential action-specific ARARs for remediation at the site include regulations established under the federal Solid Waste Disposal Act (SWDA), TSCA, CWA, CAA, Occupational Safety and Health Act (OSHA), Hazardous Waste Management Act, and their respective regulations. Potential state and local action-specific ARARs include the Georgia Water Quality Control Act, the Georgia Water Quality Control Regulations and Standards, Georgia Hazardous Waste Management Act, the Georgia Air Quality Control Law and Rules, and the City of Albany Sewerage Ordinance. Table 3-4 lists and describes potential action-specific ARARs.

3.1.3 Location-Specific ARARs

Location-specific ARARs establish restrictions on concentrations of hazardous substances or activities in specific protected locations, such as wetlands, flood plains, historic places, and sensitive habitats. Federal regulations that are location-specific ARARs for the site include the Endangered Species Act, Executive Order on Protection of Wetlands, and the Fish and Wildlife Coordination Act. Potential location-specific ARARs are listed in Table 3-5.

3.1.4 Other Criteria or Guidelines

Nonbinding criteria, advisories, and guidelines may provide useful information or recommended procedures to protect human health and the environment. These nonbinding criteria are labeled as "other criteria or guidelines to be considered" (TBCs). TBCs, although not legally binding, may provide the best available standard for a particular contaminant in which no binding standard exists. The TBCs are to be evaluated along with the ARARs to set protective cleanup level targets. Chemical-specific TBCs, such as health advisories or risk-based remediation goals, may be used to develop remediation goals in the absence of ARARs or when ARARs are not sufficiently protective. Other TBC materials such as guidance or policy documents developed to implement regulations may be considered and used as appropriate to ensure protectiveness. TBCs should only be used in setting protective cleanup levels after ascertaining that they have not been superseded by ARARs. Table 3-6 lists potential TBCs.

3.2 POTENTIAL RISK-BASED REMEDIATION GOALS

Risk-based remediation goals are concentration goals for individual chemicals in specific medium and land use combinations. Such goals are developed in the RI Report according to guidance contained in *Human Health Evaluation Manual, Part B: "Development of Risk-Based Preliminary Remediation Goals"* (U.S. EPA, 1991) for chemicals and pathways that resulted in an upper bound cancer risk of 1×10^{-6} or greater, or a Hazard Index exceeding 1.0, in the baseline risk assessment. For carcinogenic effects, chemical-specific remediation goal concentrations corresponding to incremental cancer risk levels of 1 x 10^{-6}, 1 x 10^{-5}, and 1 x 10^{-4} (where appropriate) are derived for all significant exposure pathways for a given medium. For noncarcinogenic effects, concentrations are calculated that correspond to a Hazard Index of 1 and 10 (where appropriate) from all significant exposure pathways in a given medium.

Table 3-7 summarizes the baseline risk assessment results for soil, sediment, surface water, and groundwater, as presented in the RI Report (WCC, 1992b). Chemicals in each medium that were determined to have an upperbound carcinogenic risk greater than 1 x 10^{-6} or a noncarcinogenic Hazard Index greater than 1 are also identified in this table. Potential risk-based remediation goals were derived for each of these chemicals and are presented in Table 3-8. Although additional chemicals were included in the baseline risk assessment calculations for each medium, calculation of potential risk-based remediation goals was not appropriate if the chemical was not determined to have an upperbound carcinogenic risk greater than 1 x 10^{-6} or a noncarcinogenic Hazard Index greater than 1. As an example, the chemicals considered in the baseline risk assessment for soil consisted of: 1,1,1-TCA; 4-methyl-2-pentanone; acetone; carbon disulfide; ethylbenzene; toluene; xylenes; DEHP; di-n-butylphthalate; PCBs; antimony; and zinc. However, the baseline risk assessment results indicated that calculation of potential risk-based remediation goals was only appropriate for PCBs.

The information presented in Tables 3-7 and 3-8 considers the baseline risk assessment results for each of five different exposure scenarios. However, current plant expansions indicate that no residential or other development will be conducted in the manufacturing area of the site in the foreseeable future. Thus, only the results listed for the current workers, trespassers, potential future off-site residents, and potential future on-site residents in the southern/western site need to be evaluated for potential risk-based remediation goals.

3.2.1 Additional Sampling

The U.S. EPA's *Comments on the Revised RI Report*, dated June 5, 1992, recommended resampling wells in which inorganic compounds exceeded MCLs or proposed MCLs. The U.S. EPA determined that: 1) if concentrations present in the wells are below MCLs or proposed MCLs, they may be removed from the COC list for the site groundwater; and 2) the information obtained from any additional testing was to be incorporated into the screening and evaluation portion of the FS.

An additional sampling event, which included collection of samples from 22 on-site wells, was performed by WCC in June 1992. Detailed presentation of the entire data set obtained from this sampling event is provided in an RI Addendum (WCC, 1992d). The data set includes results for seven different inorganic compounds that were previously detected at concentrations exceeding existing or proposed MCLs. The seven inorganic compounds consist of: antimony, beryllium, cadmium, chromium, lead, nickel, and thallium.

3.2.1.1 Analytical Results

Previous and current results for all of the organic and inorganic chemicals that have been identified at concentrations that exceed MCLs or other potential action levels are presented in Table 3-9. It is noted that during the course of the RI, Bridgestone/Firestone, Inc. collected both filtered and unfiltered water samples. The data from these samples are included in the final RI Report (WCC, 1992b) and the RI Addendum (WCC, 1992d). It is recognized that U.S. EPA Region IV, as a matter of policy, does not use results for filtered water samples for risk-based decision making because filtered water may not be indicative of groundwater produced by drinking water wells. U.S. EPA did not review protocols for sampling filtered groundwater at this site because these specific protocols were not included in the RI/FS Work Plan. Filtered results are included in this document even though these results were not considered for risk-based decisions or for remedy selection. Data were included at the request of Bridgestone/Firestone, Inc.

Examination of the additional sampling results for both the filtered and unfiltered samples indicates that, with two exceptions, inorganic compound concentrations in groundwater do not exceed any MCLs or other potential action levels for drinking water. The two exceptions are: 1) an 18.8 μg/l concentration of lead detected in an unfiltered sample from MW-1-4 (Residuum Well); 2) and a 27 μg/l concentration of beryllium detected in an unfiltered sample from the well designated as EMG-6 (Upper Ocala/Transition Zone Well). All other samples (filtered and unfiltered) that were

analyzed for beryllium contained concentrations less than the
the result for the filtered sample from EMG-6 indicates that
is below the 0.7 μg/l detection limit. All other samples (filtered
were analyzed for lead were similarly below lead's 15 μg/l action level.

3.2.1.2 Revised COCs

Based on the results of the additional sampling, all seven of the inorganic compounds that were originally detected at concentrations exceeding MCLs or other potential action levels for drinking water have been removed from the list of COCs to be considered in the development of the remedial actions for the site groundwater. The seven inorganic compounds consist of: antimony, beryllium, cadmium, chromium, lead, nickel, and thallium. Although the additional sampling results indicate that the action level for lead and the MCL for beryllium were each exceeded in a single unfiltered groundwater sample, the following subsections provide information that can be used to remove these two metals from consideration as COCs.

3.2.1.2.1 **Lead.** Well MW-1-4, a Residuum well located in the facility's courtyard, was found to contain an unfiltered lead concentration of 37.7 μg/l during original RI sampling. In June 1992, the concentration decreased to 18.8 μg/l. This latter value is the only concentration of lead exceeding the action level from the June 1992 sampling round. All concentrations in the Upper Ocala and the Lower Ocala were below the action level. In addition, when the unfiltered lead concentrations for the most recent samples collected from each Residuum well are averaged (Table 3-10), the average lead concentration in the Residuum (6.7 μg/l) is below lead's action level (15 μg/l). This suggests that, although one single sample is slightly above the action level, the overall lead concentration in the Residuum at the site is below the action level. It is also noted that, although the 18.8 μg/l lead concentration is slightly above the action level, it is below the current MCL of 50 μg/l, which is effective until December 7, 1992. Finally, comparison of the 18.8 μg/l lead concentration in the unfiltered groundwater sample from MW-1-4 to the 1.4 μg/l concentration in the filtered groundwater sample indicates that the unfiltered concentration is primarily due to the presence of suspended particles and not representative of dissolved metal.

3.2.1.2.2 <u>Beryllium</u>. Well EMG-6, an Upper Ocala/Transition Zone well located southeast of the storm water detention pond (in an area where no known waste handling or disposal activities have taken place), was found to contain unfiltered concentrations of beryllium of 10.7 μg/l during original RI sampling. In June 1992, the concentration increased to 27 μg/l. This latter value is the only concentration of beryllium exceeding the MCL from the June 1992 sampling round. All concentrations in the Residuum and the Lower Ocala were below the action level. In addition, when the unfiltered beryllium concentrations for the most recent samples collected from each Upper Ocala well are averaged (Table 3-10), the average concentration (2.3 μg/l) is below beryllium's MCL (4 μg/l). It is noted that a review of the most recent data indicates that all unfiltered beryllium concentrations in the manufacturing area (where the majority of chemical-handling activities took place) and in the Residuum (which would be expected to be affected first if site activities were the source of the beryllium) are below the MCL. Given the variability of sampling and analysis and the "metally" nature of groundwater in the area, as described in the RI Addendum (WCC, 1992d), the presence of beryllium cannot be positively associated with site activities. In addition, comparison of the 27 μg/l beryllium concentration in the unfiltered groundwater sample from EMG-6 to the less than 0.7 μg/l concentration in the filtered groundwater sample indicates that the unfiltered concentration is due to the presence of suspended particles and not representative of dissolved metal.

3.3 DEVELOPMENT OF MEDIUM-SPECIFIC REMEDIATION GOALS

Medium-specific remediation goals represent the final concentrations to be reached at the completion of the remedial activities. The two ways to establish the medium-specific remediation goals are: 1) adoption of regulatory standards or recommendations based on a review of the ARARs; and 2) adoption of remediation goals based on health-related criteria derived from the risk assessment process. Remediation goals have been established for groundwater and soil and are presented in the following subsections. Surface water and sediment were also evaluated during the RI, but are not included in the development of remediation goals because none of the chemical-specific cancer risks exceeded 1 x 10^{-6} or noncarcinogenic Hazard Indices exceeded the threshold comparison value of 1.0.

3.3.1 ARAR-Based Remediation Goals for Groundwater

The first step in identifying ARAR-based remediation goals for groundwater is to determine whether or not the groundwater can be used as a current or potential future source of drinking water, based on naturally occurring conditions. If groundwater is considered to be a potentially usable drinking water source, remediation goals can be established on the basis of MCLs and nonzero MCLGs. When no other promulgated standard exists, proposed MCLs and nonzero MCLGs may also be used to establish remediation goals.

Regionally, the groundwater contained within the Ocala Limestone is considered to be a potential drinking water source. Groundwater within the Residuum is not currently used as a regional or local drinking water source. Some of the monitoring wells located at the site are installed in the Residuum or straddle both the Residuum and the Upper Ocala Limestone. As stated in Section 2.0, this contact is referred to as the "Transition Zone". The higher concentrations of organic and inorganic chemicals measured in Upper Ocala/Transition Zone wells reflect Residuum water quality and are not representative of the Upper Ocala Limestone as a whole unit. The groundwater in the Residuum and Transition Zone is unlikely to represent or to be developed as a future usable drinking water source for the following reasons:

- Production data from an on-site 6-in. diameter Upper Ocala/Transition Zone well (PTW-1) has a well yield of approximately 0.1 gpm or 150 gpd. This yield is insufficient to meet the needs of an average household.

- Analytical data presented in the RI Report indicate that concentrations of aluminum, iron, and manganese have been identified above the secondary maximum contaminant levels (SMCLs) in wells located throughout the Residuum and Ocala Limestone, including wells in background locations. In addition, the highest concentrations were identified in the samples collected from the Residuum and Upper Ocala/Transition Zone wells. An SMCL is a nonenforceable guidance value addressing the aesthetics of the water (taste and odor). Exceedances of SMCLs suggest that the water would not be palatable as drinking water. A summary of available data that can be compared to the existing SMCLs is presented as Table 3-11.

- Results from the area well inventory and review presented in the final RI Report indicate that the residential and production well depths typically exceed 100 ft. The only residential well less than this depth is reported to be 12 ft. The integrity of this well as a potential potable water supply is questionable.

Although there is a potential hydraulic interconnection of this groundwater to usable drinking water in the lower portion of the Ocala, the existing manufacturing plant at the site presently obtains its drinking water from the city's municipal water supply. Current plant expansions indicate that no residential or other nonindustrial development will be conducted in this area that would change this status in the foreseeable future. Thus, none of the site groundwater located within this area is anticipated to be used as a source of drinking water. It is also unlikely that any potential future residents in the southern/western (nonmanufacturing) portion of the site would use the site groundwater due to the current immediate accessibility of the city's municipal water supply. Nonetheless, the boundary of the current manufacturing area (as defined in the baseline risk assessment presented in the RI Report) is considered to be the appropriate point of compliance for the attainment of existing or proposed MCLs and nonzero MCLGs. Compliance with MCLs and nonzero MCLGs along this boundary would be protective of public health and the environment under the site-specific circumstances.

3.3.2 Risk-Based Remediation Goals for Groundwater

Compliance with chemical-specific ARARs, such as MCLs or nonzero MCLGs, generally is considered protective even if they are outside the acceptable risk range (U.S. EPA, 1991a). However, in the absence of any existing or proposed MCLs or nonzero MCLGs, site-specific risk-based remediation goals may also be applied.

* Currently available guidance (U.S. EPA, 1991a) has indicated that where cumulative site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 1×10^{-4}, and the noncarcinogenic hazard quotient is less than 1, risk-

based remedial action is generally not warranted. None of the upper bound cancer risk levels or noncarcinogenic Hazard Indices established under the current worker, trespasser, or potential future off-site residential scenarios exceed the acceptable levels. Nonetheless, the acceptable levels are exceeded for the potential future on-site residents in the southern/western site. These results indicate that 1,1-DCE, carbon disulfide, antimony, and beryllium need to be addressed in the FS on the basis of risk because the chemical-specific cancer risks exceed 1 x 10^{-6} or noncarcinogenic Hazard Indices exceed the threshold comparison value of 1.0. However, revisions to the COC list based on the results of the June 1992 groundwater sampling, as described Section 3.1, indicate that the risk-based remediation goals calculated for antimony and beryllium do not require consideration in the development of remediation goals for the site groundwater.

Comparison of Table 3-2 and Table 3-8 indicates that MCLs or nonzero MCLGs have been promulgated for 1,1-DCE, but not for carbon disulfide. In accordance with U.S. EPA guidance, the MCLs or nonzero MCLGs (whichever is lowest) will be used as remediation goals for 1,1-DCE in the southern/western site. Since there is no existing or proposed drinking water standards for carbon disulfide, risk-based remediation goals are appropriate.

The specific risk-based remediation goal to be used for carbon disulfide is 560 μg/l. This remediation goal corresponds to a Hazard Index of 10, which is viewed as an appropriate Hazard Index for this site because the assumption made in the baseline risk assessment that potential future on-site residents depend exclusively on local groundwater from the Upper Ocala/Transition Zone is conservative and unlikely to occur.

3.3.3 Remediation Goals for Soil

As stated previously, the only chemical-specific ARAR that provides a numerical value that can be used to establish cleanup level goals for the site soils is the Georgia UST Act. For the site-specific COCs, this act requires remediation of soil contamination that exceeds 20 mg/kg BETX. However, this value would only be considered an ARAR for the former gasoline UST area located in the facility's courtyard.

*

Potential risk-based remediation goals were derived for the site soil, as described in Section 3.2. However, none of the baseline risk assessment results indicate upper bound cancer risk levels or noncarcinogenic Hazard Indices that exceed acceptable levels. Thus, the use of risk-based remediation goals is not warranted for the site soil.

For ROD

In addition to the ARAR-based and risk-based remediation goals, soil remediation activities that were conducted prior to the RI adopted 10 mg/kg as the remediation goal. This concentration also corresponds with the minimum 10 mg/kg action level provided in the U.S. EPA's *Guidance on Remedial Actions for Superfund Sites with PCB Contamination* (U.S. EPA, 1990b) and in the PCB Spill Cleanup Policy promulgated under TSCA (40 CFR 761.125). Thus, the 10 mg/kg action level is appropriate for the site soil. The referenced U.S. EPA guidance document indicates that containment, treatment, and removal can all be considered in the potential remedial actions for soils that contain PCB concentrations exceeding this action level. Long-term management controls would be required for any containment or treatment option that does not reduce the on-site PCB concentration to less than 2 mg/kg.

3.4 DELINEATION OF REMEDIATION AREAS AND VOLUMES

ROD *

Remedial action areas and volumes have been defined based on the currently available analytical results and site characterization information, and the remediation goals described in Section 3.3. The information presented herein is sufficient to scope the design of potential remedial actions. The areas and volumes are estimates based on the data available at this time.

3.4.1 Chemicals to be Remediated in Groundwater

NEXT PAGE DESCRIBES WHY DEHP SHOULD NOT BE CONSIDERED

Comparison of the RI data with the remediation goals that have been developed for the site groundwater indicates that DEHP is the only chemical identified in monitoring wells located at or beyond the boundary of the current manufacturing area (as defined in the baseline risk assessment) that exceeds the remediation goals. Specifically, the DEHP concentrations that were identified in the samples collected from Upper Ocala background well RW-10 (170 μg/l) and Lower Ocala wells DRW-7A (10 μg/l) and OW-2 (15 μg/l) exceed the recently promulgated MCL of 6 μg/l for DEHP. Additional

DEHP data for all of the existing on-site wells are included on Table 3-9 and Figures 3-1 through 3-4. Examination of the entire data set for DEHP indicates: 1) variable and scattered results for all hydrostratigraphic units; and 2) the highest concentration (170 $\mu g/l$) was detected in the sample collected from one of the site background wells (RW-10). Considering these observations, along with the facts that DEHP is a common laboratory contaminant and is not associated with the previous facility operations, further consideration of DEHP in the development and evaluation of the groundwater remediation ~~alternatives is not~~ warranted.

Although no chemicals other than DEHP were identified above the remediation goals in wells located outside of the current manufacturing area, the RI data indicate that three different VOCs were identified in Residuum and Transition Zone wells located in the facility's courtyard area at concentrations that exceed the remediation goals. The specific VOCs are 1,1,1-TCA, 1,1-DCE, and benzene. The RI data obtained for these three VOCs at all of the on-site wells are summarized on Table 3-9 and Figures 3-1 through 3-4. Examination of the data indicates that MW-1-1, MW-1-2, MW-1-3, and PTW-1 are the only monitoring wells with concentrations of 1,1-DCE, 1,1,1-TCA, or benzene that exceed the MCLs. The most recent data for monitoring well MW-1-4, which was obtained in January 1991 and prior to the RI, indicate that the concentrations of 1,1-DCE and benzene in this well may also exceed MCLs. Although the VOCs were only identified above the remediation goals in wells located within the current manufacturing area, the remedial action alternatives will address the potential migration of these contaminants to locations at or beyond this area.

For PP + ROD

In addition to the DEHP and VOC results, data collected after the initial (August 1991) RI sampling for Transition Zone well RW-2 (located near the western border of the manufacturing area) indicated an estimated PCB concentration of 0.58 $\mu g/l$. Although this concentration is slightly above the MCL of 0.5 $\mu g/l$, it is an estimated concentration that is below the contract required detection limit (CRDL) of 1.0 $\mu g/l$. In addition, PCBs were not detected in any other well at any other time. Considering the estimated and localized nature of the PCB result within the manufacturing area, along with the fact that RW-2 is not located near a potential source area, the PCB result was not judged to warrant further consideration in the development and evaluation of the groundwater remediation alternatives.

3.4.2 Chemicals to be Remediated in Soils

Analytical results from the RI indicate that none of the soil samples contain a total BETX concentration exceeding 20 mg/kg and that the only chemical detected at a level above a remediation goal is PCBs. All four of the samples found to exceed the 10 mg/kg PCB action level were collected near the former PCB transformer location designated as OT-1. PCB concentrations ranging from 17.0 to 230.0 mg/kg were identified in these four samples. Sampling depths range from 4 to 5.5 ft.

Sampling locations and analytical results for both pre-RI and RI samples that have been collected in the immediate vicinity of the former OT-1 location are presented on Figure 3-5. Sampling depths are also shown on this figure and vary from the ground surface to approximately 8 ft. The results were used to estimate the lateral and vertical extent of the soil with PCB concentrations greater than the 10 mg/kg action level.

The approximate lateral extent of the contaminated area shown on Figure 3-5 is 60 ft^2. However, the depth differences that can be observed between sampling locations indicate that additional sampling would be required to verify this estimate. Analytical results for a confirmatory soil sample collected in the contaminated area indicate a PCB concentration of less than 0.5 mg/kg at a depth of 8 ft. Assuming that the contamination extends to a depth of 8 ft over a 60 ft^2 area, the total volume of soil that exceeds the 10 mg/kg action level is estimated at 20 cu yd (30 tons).

Tables

TABLE 3-1
POTENTIAL CONTAMINANT-SPECIFIC ARARs
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Standard Requirement, Criteria or Limitation	Description	Comments
Federal		
Safe Drinking Water Act (40 USC Section 300)		
National Primary Drinking Water Standards (40 CFR Part 141)	Establishes maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs) for contaminants in drinking water.	MCLs are the maximum permissible level of a contaminant allowed in a public drinking water supply. MCLGs are the maximum level of a contaminant in public drinking water suppy at which no adverse effect on health would occur. MCLs are considered ARARs for all public drinking water supplies.
National Secondary Drinking Water Standards (40 CFR Part 143)	Establishes secondary maximum contaminant levels (SMCLs) which are non-enforceable guidelines for public water systems to ensure the aesthetic quality of the water.	SMCLs are considered ARARs for drinking water quality (color, odor, taste).

TABLE 3-1
POTENTIAL CONTAMINANT-SPECIFIC ARARs
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Standard Requirement, Criteria or Limitation	Description	Comments
Clean Water Act (33 USC Section 1251-1376)		
Toxic Pollutant Effluent Standards (40 CFR Part 129)	Establishes effluent standards for following toxic pollutants: aldrin, dieldrin, DDT, endrin, toxaphene, benzidine, and PCBs.	Not considered an ARAR for the site.
Ambient Water Quality Criteria (40 CFR Part 131 Quality Criteria for Water, 1976, 1980, 1986)	Sets water quality criteria (WQC) as non-enforceable guidelines to be used by the state in conjunction with designated uses for a stream channel to establish water quality standards.	WQC would be an ARAR if groundwater is discharged to surface water. MCLs take precedence unless WQC are more stringent. WQC must be applied if NPDES permit is required.
National Pollutant Discharge Elimination System Permit Regulations (40 CFR Parts 122, 125)	Requires permits for the discharge of pollutants from any point source into water of the United States.	Permit requirements would have to be met if groundwater is discharged to waters of the United States.
Underground Injection Control Regulations (40 CFR Parts 144-147)	Provides for protection of underground drinking water.	Would be an ARAR if treated groundwater is injected into the subsurface.

TABLE 3-1
POTENTIAL CONTAMINANT-SPECIFIC ARARs
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Standard Requirement, Criteria or Limitation	Description	Comments
National Pretreatment Standards (40 CFR Part 403)	Sets standards to control pollutants which pass through or interfere with treatment processes in POTWs or which may contaminate sewage sludge.	Considered an ARAR if groundwater is discharged to POTW.
<u>Resource Conservation and Recovery Act (RCRA) (42 USC 6901)</u>		
Identification and Listing of Hazardous Waste (40 CFR Part 261)	Defines solid wastes that are subject to regulation as hazardous waste under 40 CFR Part 262-265 and Parts 124, 270, and 271.	Any wastes at the site which are identified as hazardous will be subject to these regulations.
Land Disposal Restrictions (40 CFR Part 268)	Establish provisions for restricting the land disposal of listed and characteristic RCRA hazardous wastes as defined in 40 CFR Part 261.	Land disposal restrictions may be ARARs if residues are considered to be characteristic wastes.

TABLE 3-1
POTENTIAL CONTAMINANT-SPECIFIC ARARs
FORMER FIRESTONE FACILITY – ALBANY, GEORGIA

Standard Requirement, Criteria or Limitation	Description	Comments
Clean Air Act (42 USC 7401)		
National and Secondary Ambient Air Quality Standards (40 CFR Part 50)	Establishes standards for ambient air quality to protect public health and welfare.	Emissions of any pollutants must be within National Ambient Air Quality Standards (NAAQS).
Regulations on Standards of Performance for New Stationary Sources (40 CFR Part 60)	Regulates new stationary source emissions from specific industries, including incinerators.	It is not anticipated that any of the proposed remedial actions would be regulated as a new source.
National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61)	Regulates eight specified hazardous air pollutants and lists other air pollutants that cause serious health effects.	Any remedial action that would produce air emissions would be regulated by these standards.
Toxic Substances Control Act (TSCA) (15 USC 2601)	Authorizes U.S.EPA to establish regulations to control selected chemical substances or mixtures that pose an imminent hazard.	Soils contaminated with PCBs must be handled so as to meet standards set by TSCA.
PCB Regulations (40 CFR 761)	Establishes guidelines for storage and disposal of PCB contaminated wastes, based on contaminant levels.	Soils contaminated with PCBs will be handled in accordance with standards and specifications of these regulations.

TABLE 3-1
POTENTIAL CONTAMINANT-SPECIFIC ARARs
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Standard Requirement, Criteria or Limitation	Description	Comments
State		
Georgia Safe Drinking Water Act (SDWA)		
Rules and Regulations of the State of Georgia, Chapter 391-3-5	Establishes maximum safe drinking water contaminant levels	Clean-up levels for groundwater would require compliance if more stringent than federal regulations.
Georgia Water Quality Control Act Rules and Regulations of the State of Georgia, Chapter 391-3-6	Establishes water use classifications, water quality standards, and the state permit program. Includes instream concentrations for toxic priority pollutants.	Discharge to surface water requires compliance if more stringent than the federal regulations.
Georgia Air Quality Act		
Rules and Regulations of the State of Georgia Chapter 391-3-1	Establishes maximum safe air contaminant levels.	Air emissions would require compliance if more stringent than federal regulations.
Georgia Hazardous Waste Management Act		
Rules and Regulations of the State of Georgia, Chapter 391-3-11	Georgia hazardous waste regulations which incorporate federal hazardous waste regulations.	Hazardous waste management would require compliance if more stringent than federal regulations.

TABLE 3-1
POTENTIAL CONTAMINANT-SPECIFIC ARARs
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Standard Requirement, Criteria or Limitation	Description	Comments
Georgia Underground Storage Tank Act Rules and Regulations of the State of Georgia, Chapter 391-3-15	Establishes rules for the management of Underground Storage Tanks (USTs) and cleanup levels for TPH (100 mg/kg), BETX (20 mg/kg), and hazardous substances in soil. Requires cleanup of petroleum products to MCLs in groundwater.	The Georgia UST Act would only be considered an ARAR if a former UST can be established as the source of soil or groundwater contamination identified during the RI. All USTs were removed from the site prior to adoption of these rules in 1988 (amended in 1990 and 1991).
Local		
City of Albany Sewer Ordinance	Establishes standards for discharge into the sewer system.	Groundwater must be treated to meet discharge standards. A permit for discharge is required.

TABLE 3-2
NUMERICAL VALUES FOR POTENTIAL GROUNDWATER ARARs
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Contaminants of Concern	USEPA/Georgia MCL (μg/l)	USEPA/Georgia MCLG (μg/l)
Volatile Organic Compounds		
Acetone	—	—
Benzene	5	zero
Carbon Disulfide	—	—
Chloroform (THM)	100	—
1.1-Dichloroethane	—	—
1,1-Dichloroethylene	7	7
cis-1,2-Dichloroethylene	70	70
trans-1,2-Dichloroethylene	100	100
Ethylbenzene	700	700
4-Methyl-2-pentanone	—	—
Tetrachloroethylene	5	zero
Toluene	1000	1000
1,1,1-Trichloroethane	200	200
Trichloroethylene	5	zero
Xylenes	10000	10000
2-Butanone	—	—
2-Hexanone	—	—
Pyrene	—	—
Semi-volatile Organic Compounds		
Bis (2-ethylhexyl)phthalate	6	6
Di-n-butylphthalate	—	—
Polychlorinated biphenyls (PCBs)		
PCBs	0.5	zero
Metals		
Aluminum	—	—
Antimony	6	6
Arsenic	50	—
Beryllium	4	4
Cadmium	5	5
Chromium	100	100
Calcium	—	—
Cobalt	—	—
Copper	—	1300

TABLE 3-2
NUMERICAL VALUES FOR POTENTIAL GROUNDWATER ARARs
FORMER FIRESTONE FACILITY – ALBANY, GEORGIA

Contaminants of Concern	USEPA/Georgia MCL (μg/l)	USEPA/Georgia MCLG (μg/l)
Iron	—	—
Lead	50/15*	zero
Magnesium	—	—
Manganese	—	—
Nickel	100	100
Potassium	—	—
Selenium	50	50
Sodium	—	—
Thallium	2	0.5
Vanadium	—	—
Zinc	—	—

Notes:
MCL = Primary Maximum Contaminant Level.
MCLG = Maximum Contaminant Level Goal.
"—" indicates no listing for that chemical.
The MCL for Chloroform is based on the MCL for Total Trihalomethanes.
"*" Indicates 15 μg/l is the current action level for lead.

TABLE 3-3
NUMERICAL VALUES FOR POTENTIAL ON/OFF-SITE DISCHARGE ARARs
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Contaminants of Concern	Georgia Water Quality Criteria (1) µg/l	Georgia Water Quality Criteria (2) µg/l	Ambient Water Qualtiy Criteria (3)				Ambient Water Quality Criteria for Protection of Freshwater Aquatic Life		City of Albany POTW Discharge Requirements (4)
			For Toxic Protection		For Carcinogenic Protection				
			Ingesting Water and Orgainsms	Ingesting Organisms Only	Ingesting Water and Orgainsms	Ingesting Organisms Only	Acute	Chronic	
Acetone									
Benzene		71.28			0.66 (a)	40 (a)	5300 (c)		20
2-Butonone									
Carbon Disulfide									
Chlorinated ethanes									700
Chloroform		470.8			0.19	15.7	28900 (c)	1240 (c)	4
1,1 -Dichloroethane									
1,1-Dichloroethylene		3.2			0.033 (a)	1.85 (a)	11600 (c)		
1,2-Dichloroethylene					0.033 (a)	1.85 (a)	11600 (c)		
Trans-1,2-Dichloroethylene		136319							
Total Dichloroethylenes									20
Ethylbenzene		28718	1400	3260				32000 (c)	7
2- Hexanone									
4- Methyl-2-pentanone									
Tetrachloroethylene		8.85			0.8 (a)	8.85 (a)	5280 (c)	840 (c)	
Toluene		301941	14300	424000			17500 (c)		2000
1,1,1-Trichloroethane									200
Trichloroethylene		80.7			2.7 (a)	80.7 (a)	4500 (c)	21900 (c)	20
Xylenes									10000
Pyrene		0.0311							
Bis(2-ehtylhexyl)phthalate		5.92							
Di-n-butylphthalate		12100	35000	154000					15
PCB-1016	0.014	0.00045						0.014	
PCB-1221	0.014	0.00045							
PCB-1232	0.014	0.00045							

TABLE 3-3
NUMERICAL VALUES FOR POTENTIAL ON/OFF-SITE DISCHARGE ARARs
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Contaminants of Concern	Georgia Water Quality Criteria (1) µg/l	Georgia Water Quality Criteria (2) µg/l	Ambient Water Qualtiy Criteria (3)				Ambient Water Quality Criteria for Protection of Freshwater Aquatic Life		City of Albany POTW Discharge Requirements (4)
			For Toxic Protection		For Carcinogenic Protection				
			Ingesting Water and Orgainsms	Ingesting Organisms Only	Ingesting Water and Orgainsms	Ingesting Organisms Only	Acute	Chronic	
PCB-1242	0.014	0.00045							
PCB-1248	0.014	0.00045			0.000079 (a)	0.000079 (a)	2.0	0.014	
PCB-1254	0.014	0.00045			0.000079 (a)	0.000079 (a)	2.0	0.014	
PCB-1260	0.014	0.00045							
Aluminum								87	
Antimony		4308	146	45000			9000 (c)	1600 (c)	
Arsenic	50	0.14			0.0022 (a)	0.0175 (a)			40
Barium			1000						1200
Beryllium		0.117			0.0068 (a)	0.117 (a)	130 (c)	5.3 (c)	
Cadmium	0.7		10				3.9 (b)	1.1 (b)	120
Calcium									
Chromium	120		50				16 (b) (c)	11 (b)	600
Cobalt									
Copper	6.5						18 (b)	18 (b)	125
Iron			300					1000	800
Lead	1.3		50				82 (b)	3.2 (b)	380
Magnesium									
Manganese			50	100			130	5.3	
Nickel	88							160	2400
Potassium									
Selenium	5		10				280	35	185
Sodium									
Thallium		48	13	48			1400 (c)	40 (c)	

TABLE 3-3
NUMERICAL VALUES FOR POTENTIAL ON/OFF-SITE DISCHARGE ARARs
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Contaminants of Concern	Georgia Water Quality Criteria (1) µg/l	Georgia Water Quality Criteria (2) µg/l	Ambient Water Qualtiy Criteria (3) For Toxic Protection Ingesting Water and Orgainsms	Ambient Water Qualtiy Criteria (3) For Toxic Protection Ingesting Organisms Only	Ambient Water Qualtiy Criteria (3) For Carcinogenic Protection Ingesting Water and Orgainsms	Ambient Water Qualtiy Criteria (3) For Carcinogenic Protection Ingesting Organisms Only	Ambient Water Quality Criteria for Protection of Freshwater Aquatic Life Acute	Ambient Water Quality Criteria for Protection of Freshwater Aquatic Life Chronic	City of Albany POTW Discharge Requirements (4)
Vanadium									
Zinc	60						120 (b)	110 (b)	1500

Notes:

All values expressed in µg/l (ppb).
(1) Instream concentrations for 7-day, 10-year minimum flow or higher stream flow conditions.
(2) Instream concentrations for annual average or higher stream flow conditions.
(3) Quality Criteria for Water (U.S. EPA, 1986)
(4) The city of Albany regulates the discharge of priority pollutants on a case-by-case basis. The requirements listed in this table are for nondomestic users discharging toxic priority pollutants.
(a) Human health criteria for carcinogens reported for three risk levels. Value reported is the 10E-6 level.
(b) Hardness dependent criteria (100 mg/l used)
(c) Insufficient data to develop criteria. Value presented as lowest observed effect level (LOEL).

TABLES\ALBANY\3-3

TABLE 3-4
POTENTIAL ACTION-SPECIFIC ARARs
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Standard Requirement, Criteria or Limitation	Description	Comments
Federal		
Solid Waste Disposal Act (SWDA) 42 USC Sect. 6901-6987 as amended by the Resource Recovery Act of 1976 (RCRA)		
Criteria for Classification of Solid Waste Disposal Facilities and Practices (40 CFR Part 257)	Establishes criteria for determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on health and thereby constitute prohibited open dumps.	This is an ARAR if an alternative developed involves the land disposal of solid waste.
Hazardous Waste Management Systems General (40 CFR Part 260)	Establishes procedures and criteria for modification or revocation of any provision in 40 CFR Parts 260-265	Might be an ARAR if a substance at the site were to be excluded from the list of hazardous waste.
Identification and Listing of Hazardous Waste (40 CFR Part 261)	Defines those solid wastes which are subject to regulation as hazardous wastes under 40 CFR Parts 263-265 and Parts 124, 270, and 271.	Any substances considered to be hazardous wastes would have to be handled as such. Regulations must be considered in determining if groundwater treatment residuals are characteristic wastes.

TABLE 3–4
POTENTIAL ACTION–SPECIFIC ARARs
FORMER FIRESTONE FACILITY – ALBANY, GEORGIA

Standard Requirement, Criteria or Limitation	Description	Comments
Standards Applicable to Generators of Hazardous Waste (40 CFR Part 262)	Establishes standards for generators of hazardous waste.	These standards would be considered as ARARs if any alternatives involve generation of hazardous materials.
Standards Applicable to Transportors of Hazardous Waste (40 CFR Part 263)	Establishes standards which apply to persons transporting hazardous waste within the U.S. if the transportation requires a manifest under 40 CFR Part 262.	These standards would be considered ARARs for any hazardous materials transported off–site.
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (40 CFR Part 264)	Establishes minimum national standards that define the acceptable management of hazardous waste for owners and operators of facilities that treat, store, or dispose of hazardous waste.	If an alternative would involve excavation and on–site treatement, storage, or disposal or if groundwater treatment residuals are characteristic wastes, these standards would be considered ARARs.

TABLE 3-4
POTENTIAL ACTION-SPECIFIC ARARs
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Standard Requirement, Criteria or Limitation	Description	Comments
Interim Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (40 CFR Part 265)	Establishes minimum national standards that define the acceptable management of hazardous waste durng the period of interim status and until certification of final closure, or if the facility is subject to post-closure requirements, until post-closure responsibilities are fulfilled.	Remedies should be consistent with the more stringent part 264 standards because these represent the ultimate RCRA compliance standards and are consistent with CERCLA's goal of long-term protection of public health and welfare and the environment.
Standards for the Management of Specific Hazardous Waste and Specific Types of Hazardous Waste Management Facilities (40 CFR Part 266)	Establishes requirements that apply to recyclable materials that are reclaimed to recover economically significant amounts of precious metals, including gold and silver.	No recyclable materials are known to exist at the site.
Interim Standards for Owners and Operators of New Hazardous Waste Land Disposal Facilities (40 CFR Part 267)	Establishes minimum national standards that define acceptable management of hazardous waste for new land disposal facilities.	Remedies should be consistent with the more stringent part 264 standards because these represent the ultimate RCRA compliance standards and are consistent with CERCLA's goal of long-term protection of public health and welfare and the environment.

TABLE 3-4
POTENTIAL ACTION-SPECIFIC ARARs
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Standard Requirement, Criteria or Limitation	Description	Comments
Land Disposal Restrictions (40 CFR Part 268)	Identifies hazardous wastes that are restricted from land disposal and defines those circumstances under which an otherwise prohibited waste could continue to be land-disposed.	If a groundwater alternative developed would involve placement of characteristic wastes, this part would be an ARAR.
Hazardous Waste Permit Program (40 CFR Part 270)	Establishes provisions covering basic U.S. EPA permitting requirements.	A permit is not required for on-site CERCLA response action. Substantive requirements are addressed in 40 CFR Part 264.
Underground Storage Tanks (40 CFR Part 280)	Establishes regulations related to underground storage tanks.	No underground storage tanks exist at the site. However, these regulations would be considered ARARs if an alternative would involve use of underground storage tanks.
<u>Toxic Substances Control Act (TSCA) (15 USC 2601)</u>	Authorizes U.S. EPA to establish regulations to control selected chemical substances or mixtures that pose an imminent hazard.	Soils contaminated with PCBs must be disposed to meet standards set by TSCA.

TABLE 3–4
POTENTIAL ACTION–SPECIFIC ARARs
FORMER FIRESTONE FACILITY – ALBANY, GEORGIA

Standard Requirement, Criteria or Limitation	Description	Comments
PCB Regulations (40 CFR 761)	Establishes guidelines for storage and disposal of PCB contaminated wastes, based on contaminant levels.	Soils contaminated with PCBs will be handled in accordance with standards and specifications of these regulations.
Occupational Safety and Health Act (29 USC Section 651–658)	Regulates workers' health and safety.	All work performed on–site must comply with OSHA standards.
Clean Air Act (42 USC Section 7401–7642)		
National Ambient Air Quality Standards (40 CFR Part 50)	Treatment technology standard for emissions to air from: incinerators, surface impoundments, waste piles, landfills, and fugitive emissions.	If an alternative involves emissions governed by these standards, then the requirements would be considered ARARs.
Hazardous Materials Transportation Act (49 USC Section 1801–1813)		
Hazardous Materials Transportation Regulations (49 CFR 107, 171–177)	Regulates the transporation of hazardous materials.	Regulations considered ARARs if hazardous waste would be transported off–site.

TABLE 3-4
POTENTIAL ACTION-SPECIFIC ARARs
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Standard Requirement, Criteria or Limitation	Description	Comments
Safe Drinking Water Act		
Underground Injection Control Regulations (40 CFR Parts 144-147)	Provides protection of underground sources of drinking water.	If an alternative involves underground injection, this part is an ARAR.
Clean Water Act		
National Pollutant Discharge Elimination System (40 CFR Parts 122, 125)	Requires permit for the discharge of pollutants from any point source into waters of the United States.	No permit is required for on-site CERCLA remedial actions, but the substantive requirements would apply if an alternative developed would include surface water discharge.
National Pretreatment Standards (40 CFR Part 403)	Sets standards to control pollutants that pass through or interfere with treatment processes in publicly owned treatment works or that may contaminate sewage sludge.	If an alternative involves discharge to publicly owned treatment works, this part would be an ARAR.

TABLE 3-4
POTENTIAL ACTION-SPECIFIC ARARs
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Standard Requirement, Criteria or Limitation	Description	Comments
Toxic Pollutant Effluent Standards (40 CFR Part 129)	Establishes effluent standards or prohibition for certain toxic pollutants: Aldrin, Dieldrin, DDT, Endrin, Toxphene, Benzidine, and PCBs.	Not considered an ARAR for the site.
Dredge and Fill Requirements (Section 404) (40 CFR Parts 230, 231)	Requires permits for discharge of drege or fill material into navigable waters.	No alternative is anticipated to be developed that would discharge of dredge or fill material into navigable waters.
State		
<u>Georgia Water Quality Control Act (Code of Georgia, Title 12, Chapter 5)</u>	Oversees the the quality and quantity of the state's water resources. Authorizes the Georgia DNR to etablish water quality standards and issue discharge permits.	
Rules and Regulations of the State of Georgia, Chapter 391-3-6, Section 06	Establishes the uniform procedures and practices to be followed relating to the application for issuance, modification, revocation, and reissuance and termination of permits for the discharge of any pollutant into the waters of the State.	Considered ARARs for surface water discharge where they are more stringent than federal regulations.

TABLE 3-4
POTENTIAL ACTION-SPECIFIC ARARs
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Standard Requirement, Criteria or Limitation	Description	Comments
Rules and Regulations of the State of Georgia, Chapter 391-3-6 Section 08	Establishes degree of wastewater pre-treatment required and the uniform procedures and practices to be followed relating to the application for issuance, modification, revocation, reissuance, and termination of permits for discharge of any pollutant into POTW and then into waters of the State.	Groundwater discharged into POTW must meet this standard, and a permit is required.
Rules and Regulations of the State of Georgia, Chapter 391-3-6 Section 10	Establishes the procedures and practices to be followed for the determination or categorization of industrial users and requests for variances for fundamentally different factors.	

TABLE 3-4
POTENTIAL ACTION-SPECIFIC ARARs
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Standard Requirement, Criteria or Limitation	Description	Comments
Rules and Regulations of the State of Georgia, Chapter 391-3-6 Section 11	Establishes the degree of pollutant treatment required and the uniform procedures and practices to be followed relating to the application for issuance, modification, revocation, and reissuance and termination of permits for the discharge of any pollutant into land disposal or land treatment systems and then into the waters of the State.	Groundwater discharged to a land disposal or treatment system must meet this standard and a permit is required.
Georgia Air Quality Control Law (Code of Georgia, Title 12, Chapter 9)	Authorizes Georgia DNR to preserve, protect and improve air quality; to control emissions to prevent the significant deterioration of air quality; and to attain and maintain ambient air quality standards.	
Rules and Regulations of the State of Georgia, Chapter 391-3-1	Establishes maximum safe air contaminant levels.	Considered ARARs for air emissions where more stringent than federal regulations.

TABLE 3-4
POTENTIAL ACTION-SPECIFIC ARARs
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Standard Requirement, Criteria or Limitation	Description	Comments
Georgia Hazardous Waste Management Act		
Code of Georgia, Title 12 - Chapter 8, Article 3 Section 62	Defines designated hazardous waste based on the federal act (40 CFR Section 261)	All designated hazardous waste would have to be handled under the provisions of this act.
Code of Georgia, Title 12 - Chapter 8, Article 3 Section 66	Established the need for a hazardous waste facility permit.	If hazardous waste will be treated at the site, a permit would be required.
Code of Georgia, Title 12 - Chapter 8, Article 3 Section 69	Establishes that variances may be granted from the requirements of this law unless such variances are prohibited by the federal act or standards.	If hazardous waste will be treated at the site, this regulation may be considered an ARAR.
Georgia Hazardous Site Response Act	Provides incentives for the reduction of hazardous waste generation and management in Georgia and requires corrective action for releases of hazardous wastes, hazardous constituents, and hazardous substances.	

TABLE 3-4
POTENTIAL ACTION-SPECIFIC ARARs
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Standard Requirement, Criteria or Limitation	Description	Comments
Georgia Hazardous Waste Management Rules		
Rules and Regulations of the State of Georgia, Chapter 391-3-11	Establishes the policies, procedures, requirements and standards to implement the Georgia Hazardous Waste Management Act.	The management of any hazardous waste at the site must comply with these standards.
Local		
City of Albany Sewer Ordinance	Establishes standards for discharge into the sewer system.	Groundwater must be treated to meet discharge standards. A permit for discharge is required.

TABLE 3-5
POTENTIAL LOCATION-SPECIFIC ARARs
FORMER FIRESTONE FACILITY – ALBANY, GEORGIA

Standard Requirement, Criteria or Limitation	Description	Applicability
Federal		
Archaeological and Historic Preservation Act (16 USC 469)	Provides for the preservation of historical and archaeological data that otherwise may be lost due to remedial actions.	If these data are located at the site, these regulations would be an ARAR. These data are not expected to be located at the site.
Endangered Species Act (16 USC 1531)	Requires action to conserve endangered or threatened species and critical habitats upon which endangered species depend. Includes consultation with the Department of Interior.	If endangered or threatened species or their habitats are identified on the site, these regulations would apply to remedial actions on the site. No endangered species or habitats have been identified at the site.
Executive Order on Protection of Wetlands (Executive Order 11,99040 CFR 6.302(a) and Appendix A)	Each agency shall provide leadership and shall take action to minimize the destruction, loss, or degradation of wetlands, and preseve and enhance the natural and beneficial balues of wetlands.	Remedial actions at the site affecting on-site wetlands will be regulated by this order.

TABLE 3-5
POTENTIAL LOCATION-SPECIFIC ARARs
FORMER FIRESTONE FACILITY – ALBANY, GEORGIA

Standard Requirement, Criteria or Limitation	Description	Applicability
Executive Order on Floodplain Management (Executive Order No. 11,988) (40 CFR Part 6 Subpart A)	Actions that are to occur in flood plains should avoid adverse effects, minimize potential harm, restore and preserve natural and beneficial value.	The site is not located in a 100-year floodplain.
100-Year Floodplain Management (40 CFR 264.181)	RCRA treatment, storage, or disposal facilities must be designed, constructed, operated, and maintained to avoid washout within a 100-year floodplain.	The site is not located in a 100-year floodplain.
Fish and Wildlife Coordination Act (16 USC 2901)	Requires consideration of the effects remedial actions will have on fish and wildlife.	The U.S. Fish and Wildlife Service and the Georgia Department of Natural Resources will be consulted prior to beginning remedial actions.
Historic Sites, Buildings, and Antiquities Act (16 USC 461-467)(40 CFR Section 6.301(c))	Identifies historic landmarks in the National Registry of Natural Landmarks and provides for their preservation.	No National Registry of Landmarks listed sites have been identified at the site.

TABLE 3-5
POTENTIAL LOCATION-SPECIFIC ARARs
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Standard Requirement, Criteria or Limitation	Description	Applicability
National Historic Preservation Act (16 USC Sect. 470) (40 CFR Section 6301(b)) (36 CFR Part 800)	Identifies historic landmarks in the National Register of Historic Places and provides for their preservation.	No National Registry of Historic Places listed sites have been identified at the site.
National Wildlife Refuge System (50 CFR 27)	Places restrictions on activities within a National Wildlife Refuge.	No National Wildlife Refuge sites are in the vicinity of the site.
Rivers and Harbors Act of 1899 (33 USC 401-413)	Requires a permit for structures or work in or affecting navigable waters.	Navigable waters are not located within the vicinity of the site.
Scenic Rivers Act (16 USC 1271, 40 CFR 6.302(3))	Preserves wild, scenic, or recreational rivers and establishes requirements applicable to projects affecting such rivers within the National Wild and Scenic Rivers System.	The site is not located within the National Wild and Scenic Rivers System.
Wilderness Act (16 USC 1131)	Creates the National Wilderness Preservation System.	The site is not located within the National Wilderness System.

TABLE 3-6
POTENTIAL FEDERAL AND STATE CRITERIA, ADVISORIES
AND GUIDANCE TO BE CONSIDERED
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

GENERAL CRITERIA, ADVISORIES AND PROCEDURES

- Health Effects Assessments (HEAs) and Proposed HEAs, (U.S. EPA, 1985).
- References Doses (RfDs), (U.S. Health Advisories, Office of Drinking Water, March 31, 1987).
- Carcinogen Potency Factors (CPFs) (U.S. EPA, Office of Health and Environmental Assessment, July 1985).
- Public health criteria on which the decision to list pollutants as hazardous under Section 112 of the Clean Air Act was based.
- Guidelines for Ground-water Classification Under the EPA Ground-Water Protection Strategy.
- TSCA Compliance Program Policy, (U.S. EPA, OECM, OPTS, March 1985).
- Guidance on Remedial Actions for Superfund Sites with PCB Contamination (U.S. EPA, August 1990).
- TSCA PCB Spill Cleanup Policy.
- Final Report for Task 1-04 PCB Spill Cleanup Policy Evaluation (U.S. EPA, December 1988).

- OSHA health and safety standards that may be used to protect public health (non-workplace).

- Health Advisories, U.S. EPA, Office of Water.

- EPA Water Quality Advisories, U.S. EPA, Office of Water, Criteria and Standards Division.

- Proposed Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs)

U.S. EPA RCRA GUIDANCE DOCUMENTS

- RCRA Design Guidelines for surface impoundments, waste piles, land treatment units, and landfills

- Permit Writer's Guidance Manual for Hazardous Waste Land Treatment, Storage and Disposal Facilities, Phase I; (February 15, 1985) EPA/530-SW-85-024.

- Permit Writer's Guidance Manual for Subpart F. (October 1983).

- Permit Applicant's Guidance Manual for the General Facility Standards. (October 15, 1983) EPA #OSW 00-00-968.

- Waste Analysis Plan Guidance Manual. (October 15, 1984) EPA/530-SW-84-012.

- Technical Resource Documents (TRDs) related to aspects of design of on-site disposal alternatives.

U.S. EPA OFFICE OF WATER GUIDANCE DOCUMENTS

- 304(g) Guidance Document Revised Pretreatment Guidelines (3 Volumes)

- Guidance for POTW Pretreatment Program Manual (October 1983)

- Developing Requirements for Direct and Indirect Discharges of CERCLA Wastewater, Draft. (1987).

- Guidance for Implementing RCRA Permit by Rule Requirements at POTWs.

- Application of Correction Action Requirements at Publicly Owned Treatment Works.

- Draft Guidance Manual on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program (1987).

- Water-Related Environmental Fate of 129 Priority Pollutants (1979)

- Water Quality Standards Handbook (December 1983)

- Technical Support Document for Water Quality-based Toxics Control. (1983).

- NPDES Best Management Practices Guidances Manual (June 1982).

- Case studies on toxicity reduction evaluation (May 1983).

- Designation of Useable Source for Drinking Water (USDW) (No. 7.1, October 1979)

- Elements on aquifer identification (No. 7.2, October 1979)

- Ground-water Protection Strategy (August 1984).

- Clean Water Act Guidance Documents

NONPROMULGATED STATE ADVISORIES

- Guideline for Ambient Impact Assessment of Toxic Air Pollutant Emissions (Georgia DNR, Air Pollution Control, July 1984)
- Air Pollution Compliance Memorandum, Groundwater Cleanup Action (Georgia DNR, August 1989)
- A Ground-Water Management Plan for Georgia, Circular 11 (Georgia DNR, Environmental Protection Division, 1991)

TABLE 3-7
SUMMARY OF CANCER RISK AND NONCARCINOGENIC HEALTH HAZARD ESTIMATES
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

RECEPTOR	MEDIUM	NON-CARCINOGENIC HAZARD INDEX (all exposure routes)	CHEMICALS WITH HAZARD QUOTIENT GREATER THAN 1	CLEANUP LEVELS DERIVED?	UPPERBOUND CANCER RISK (all exposure routes)	CHEMICAL WITH A RISK GREATER THAN $1x10^{-6}$	CLEANUP LEVELS DERIVED?
Current Worker	* Soil	0.06	None	No	$3x10^{-5}$	PCBs	Yes
	Sediments	0.0008	None	No	$1x10^{-7}$	None	No
	Surface Water	0.0002	None	No	--	--	No
Adult Trespassers	Soil	0.3	None	No	$2x10^{-8}$	None	No
	Sediments	0.005	None	No	$1x10^{-6}$	NA	No
	Surface Water	0.03	None	No	NA	None	No
Youth Trespassers	Soil	0.5	None	No	$8x10^{-9}$	None	No
	Sediments	0.006	None	No	$5x10^{-7}$	--	No
	Surface water	0.04	None	No	--	--	No

TABLE 3-7 (continued)
SUMMARY OF CANCER RISKS AND NONCARCINOGENIC HEALTH HAZARD ESTIMATES
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

RECEPTOR	MEDIUM	NON-CARCINOGENIC HAZARD INDEX (all exposure routes)	CHEMICALS WITH HAZARD QUOTIENT GREATER THAN 1	CLEANUP LEVELS DERIVED ?	UPPERBOUND CANCER RISK (all exposure routes)	CHEMICAL WITH A RISK GREATER THAN $1x10^{-6}$	CLEANUP LEVELS DERIVED ?
* Potential Adult Off-Site Residents	Groundwater	0.04	None	No	$7x10^{-5}$	1,1-DCE	Yes
* Potential On-site residents - Mfg. Area	Groundwater	28	Antimony Chromium Manganese Vanadium	Yes	$3x10^{-3}$	1,1-DCE Benzene DEHP Beryllium	Yes
*	Soil	0.3	~~None~~	No	$5x10^{-5}$	PCBs	Yes
Potential On-Site Residents - Southern Site	Groundwater	17	Antimony Carbon Disulfide	Yes	$7x10^{-4}$	Beryllium 1,1-DCE	Yes

TABLE 3-8
SUMMARY OF POTENTIAL RISK-BASED REMEDIATION GOALS
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

	EXPOSURE PATHWAY	CHEMICAL	TARGET CLEANUP LEVEL AT CANCER RISK OF 10^{-6}	TARGET CLEANUP LEVEL AT CANCER RISK OF 10^{-5}	TARGET CLEANUP LEVEL AT CANCER RISK OF 10^{-4}	TARGET CLEANUP LEVEL AT A HAZARD INDEX OF 1	TARGET CLEANUP LEVEL AT A HAZARD INDEX OF 10
	Current Worker						
1	Soil Contact	PCB	0.11 mg/kg	1.1 mg/kg	ND	--	--
	Potential Off-Site Resident						
1g	Groundwater Contact	1,1-DCE	0.078 μg/l	0.78 μg/l	ND	--	--
	Potential On-Site Resident - Manufacturing Area						
	Groundwater Contact	1,1-DCE	0.053 μg/l	0.53 μg/l	5.3 μg/l	--	--
2g		Benzene	1.4 μg/l	14 μg/l	140 μg/l	--	--
		DEHP	3.1 μg/l	31 μg/l	310 μg/l	--	--
		Antimony	--	--	--	6.2 μg/l	62 μg/l

TABLE 3-8 (continued)
SUMMARY OF POTENTIAL RISK-BASED REMEDIATION GOALS
FORMER FIRESTONE - ALBANY, GEORGIA

EXPOSURE PATHWAY	CHEMICAL	TARGET CLEANUP LEVEL AT CANCER RISK OF 10^{-6}	TARGET CLEANUP LEVEL AT CANCER RISK OF 10^{-5}	TARGET CLEANUP LEVEL AT CANCER RISK OF 10^{-4}	TARGET CLEANUP LEVEL AT A HAZARD INDEX OF 1	TARGET CLEANUP LEVEL AT A HAZARD INDEX OF 10
29cont Groundwater Contact	Beryllium	0.051 μg/l	0.15 μg/l	1.5 μg/l	--	--
	Chromium	--	--	--	70.8 μg/l	708 μg/l
	Manganese	--	--	--	1406 μg/l	14,062 μg/l
	Vanadium	--	--	--	108 μg/l	1,079 μg/l
Soil Contact	PCB	0.045 mg/kg	0.45 mg/kg	ND	--	--
Potential On-Site Residents - Southern Site						
Groundwater Contact 39	Antimony	--	--	--	6.1 μg/l	61 μg/l
	Beryllium	0.015 μg/l	0.15 μg/l	1.5 μg/l	--	--
	Carbon disulfide	--	--	--	56 μg/l	560 μg/l

TABLE 3-8 (continued)
SUMMARY OF POTENTIAL RISK-BASED REMEDIATION GOALS
FORMER FIRESTONE - ALBANY, GEORGIA

EXPOSURE PATHWAY	CHEMICAL	TARGET CLEANUP LEVEL AT CANCER RISK OF 10^{-6}	TARGET CLEANUP LEVEL AT CANCER RISK OF 10^{-5}	TARGET CLEANUP LEVEL AT CANCER RISK OF 10^{-4}	TARGET CLEANUP LEVEL AT A HAZARD INDEX OF 1	TARGET CLEANUP LEVEL AT A HAZARD INDEX OF 10
Groundwater Contact	1,1-DCE	0.059 $\mu g/l$	0.59 $\mu g/l$	5.9 $\mu g/l$	--	--

1. Target cleanup levels (TCLs) are developed only for exposures to media that resulted in an overall cancer risk greater than $1x10^{-6}$ or an overall Hazard Index of greater than 1.0. The TCL was based on achieving a chemical-specific risk of $1x10^{-6}$ or a chemical-specific hazard index of 1.0, when all exposure routes were considered (OSWER Directive 9285.7, 12/13/91).

2. The TCLs for 1,1-DCE for the potential on-site residential exposure in the manufacturing area and southern site area differ slightly due to rounding during calculations. The TCLs for the potential off-site residential exposure vary from the potential on-site residential exposure because adults were the only assessed receptors in this section.

3. The TCLs for antimony differ slightly due to rounding during calculations.

ND Remediation goals were not developed because baseline risks were less than this level.

TABLE 3-9
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS - ORGANIC/INORGANIC COMPOUNDS EXCEEDING MCLs/MCLGs
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA ($\mu g/l$)

Chemical of Concern		1,1,1-TCA	1,1-DCE	Benzene	DEHP	Antimony	Beryllium	Cadmium	Chromium	Lead	Nickel	Thallium
MCL/MCLG		200/200	7/7	5/0	6/6	6/6	4/4	5/5	100/100	15/0	100/100	2/0.5
Residuum Wells	Sampling Date											
MW-1-2	08/14/91(uf)	5.0 U	5.0 U	+31	18.0 U	17.4 U	1.0 U	2.0 U	14.1 U	4.7 U	8.4 U	2.0 U
	12/12/91(uf)	--	--	--	--	+9.5 B	1.0 U	2.0 U	6.0 UJ	7.2	17.0 U	1.0 UWNJ
	12/12/91(f)	--	--	--	--	7.0 U	1.0 U	2.0 U	6.0 UJ	1.0 U	17.0 U	1.0 UNJ
	6/92(uf)	--	--	--	--	17.4 U	--	--	--	--	--	--
	6/92(f)	--	--	--	--	17.4 U	--	--	--	--	--	--
MW-1-4	01/24/91**	0.5 U	+24	+86	10.0 U	--	--	--	--	--	--	--
	08/15/91(uf)	--	--	--	--	54.7 U	+4.3 B	9.6 U	72.9	+37.7	+101	2.0 B
	6/92(uf)	--	--	--	--	--	0.71 B	--	30.0	+18.8	43.8	0.6 U
	6/92(f)	--	--	--	--	--	1.2	--	4.6 U	1.4 B	9.7 B	0.6 U
MW-7-8	08/15/91(uf)	4.0 J	8.0 U	8.0 U	+17 J	24.2 U	1.0 U	2.1 U	31.8 U	8.2 U	10.5 U	2.0 U
MW-12-1	08/17/91(uf)	19.0	7.0	5.0 U	10.0 U	19.5 U	1.0 U	2.8 U	15.0 U	4.8 U	10.1 U	2.0 U
	09/30/91(uf)	24	6	5.0 U	10.0 U	13.3 U	1.0 U	2.8 U	15.0 U	4.8 U	17.0 U	1.0 UW
MW-12-1B	09/30/91(uf)	5.0 J	2.0 J	5.0 U	3.0 B	22.4 U	2.0 B	3.7 U	25.6	7.5	28.4 B	1.0 U
MW-14	10/01/91(uf)	5.0 U	5.0 U	5.0 U	10.0 U	+74.6	1.0 U	2.0 U	64.4	+15.9	26.9 B	1.0 U
	6/92(uf)	--	--	--	--	17.4 U	--	--	4.6 U	2.1 B	--	--
	6/92(f)	--	--	--	--	17.4 U	--	--	4.6 U	0.8 B	--	--
BMW-3	08/20/91(uf)	5.0 U	3.0 J	5.0 U	10.0 U	15.7 U	2.1 B	2.0 U	33.7	+25.8	6.0 U	2.0 U
	6/92(uf)	--	--	--	--	--	--	--	--	1.2 B	--	--
	6/92(f)	--	--	--	--	--	--	--	--	0.6 U	--	--
BMW-4	08/22/91(uf)	12.0 U	12.0 U	5.0 U	29.0 BR	11.6 U	1.2 B	2.0 U	13.6	6.6	3.0 U	2.0 U
EMG-5A	08/21/91(uf)	0.7 J	0.4 J	12.0 U	10.0 U	11.5 U	+6.5	2.0 U	39.5	+18.2	23.8 U	2.0 U
	6/92(uf)	--	--	--	--	--	2.4 B	--	--	8.4	--	--
	6/92(f)	--	--	--	--	--	0.7 U	--	--	1.0 B	--	--

TABLE 3-9
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS – ORGANIC/INORGANIC COMPOUNDS EXCEEDING MCLs/MCLGs
FORMER FIRESTONE FACILITY – ALBANY, GEORGIA ($\mu g/l$)

Chemical of Concern		1,1,1-TCA	1,1-DCE	Benzene	DEHP	Antimony	Beryllium	Cadmium	Chromium	Lead	Nickel	Thallium
MCL/MCLG		200/200	7/7	5/0	6/6	6/6	4/4	5/5	100/100	15/0	100/100	2/0.5
Residuum Wells	Sampling Date											
^ BMW-2	08/17/91	5.0 U	5.0 U	5.0 U		+82.3	+4.8 B	3.2 U	+143	+56.7	40.8	2.0 U
	12/12/91(uf)	--	--	--	--	+9.8 B	1.0 U	2.0 U	6.0 UJ	2.3 B	17.0 U	1.0 UWNJ
	12/12/91(f)	--	--	--	--	+12.1 B	1.0 U	2.0 U	6.0 UJ	1.0 U	17.0 U	1.0 UWNJ
	6/92(uf)	--	--	--	--	17.4 U	0.7 U	1.5 U	4.6 U	2.5 B	3.0 U	0.6 U
	6/92(f)	--	--	--	--	17.4 U	0.7 U	1.5 U	4.6 U	0.6 U	3.0 U	0.6 U
Upper Ocala Wells												
* MW-1-1	08/14/91(uf)	15.0 B	6.0	+71	10.0 U	28.4 U	1.7 B	4.0 U	53.9	14.1	24.3 U	2.0 U
	6/92(uf)	--	--	--	--	--	--	--	5.9 B	--	--	--
	6/92(f)	--	--	--	--	--	--	--	4.6 U	--	--	--
* MW-1-3	08/23/91(uf)	+560 D	+1400	50.0 U	11.0 BR	21.6 U	3.6 B	2.0 U	+184	+92.2 S	27.5 U	2.0 U
	6/92(uf)	--	--	--	--	--	--	--	5.1 B	2.6 B	--	--
	6/92(f)	--	--	--	--	--	--	--	4.6 U	0.6 B	--	--
* MW-1-5	08/21/91(uf)	3.0 J	5.0 J	5.0 U		27.8 U	+13.2	+8.5	72.4	+82.4 S	99.1	2.0 U
	6/92(uf)	--	--	--	--	--	2.3 B	2.7 B	8.1 B	11.7	--	--
	6/92(f)	--	--	--	--	--	0.7 U	1.5 U	4.6 U	0.6 U	--	--
* MW-1-6	09/05/91(uf)	5.0 U	5.0 U	5.0 U	10.0 UJ	9.0 U	+8.1	2.0 U	+160	+91.6	59.6	2.0 U
	6/92(uf)	--	--	--	--	--	0.7 U	--	5.5 B	12.3	--	--
	6/92(f)	--	--	--	--	--	0.7 U	--	4.6 U	0.6 U	--	--
* MW-7-5	08/15/91(uf)	28.0 B	7.0	5.0 U	+70	+119	+45.7	+42.5	+157	+114	+261	+5.0 B
	6/92(uf)	--	--	--	--	17.4 U	2.3 B	2.0 B	11.1	11.9	30.0 B	0.8 U
	6/92(f)	--	--	--	--	17.4 U	0.93 B	1.5 U	5.7 B	0.6 U	3.0 U	0.8 U
MW-13	10/01/91(uf)	5.0 U	5.0 U	5.0 U	10.0 U	18.9 U	1.0 U	2.4 U	10.2	1.3 B	17.0 U	1.0 U
* PTW-1	08/23/91(uf)	+220	+130	10.0 U	41.0 BR	9.0 U	1.0 U	2.0 U	3.0 U	3.1 S	3.0 U	2.0 UW

TABLE 3-9
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS – ORGANIC/INORGANIC COMPOUNDS EXCEEDING MCLs/MCLGs
FORMER FIRESTONE FACILITY – ALBANY, GEORGIA (μg/l)

Chemical of Concern		1,1,1-TCA	1,1-DCE	Benzene	DEHP	Antimony	Beryllium	Cadmium	Chromium	Lead	Nickel	Thallium
MCL/MCLG		200/200	7/7	5/0	6/6	6/6	4/4	5/5	100/100	15/0	100/100	2/0.5
Upper Ocala Wells	Sampling Date											
* EMG-1	08/20/91(uf)	5.0 U	5.0 U	5.0 U	10.0 U	17.6 U	2.5 B	2.0 U	9.8 B	7.1	3.3 U	2.0 UW
	6/92(uf)	--	--	--	--	--	--	--	--	--	--	--
	6/92(f)	--	--	--	--	--	--	--	--	--	--	--
* EMG-2	08/22/91(uf)	5.0 U	5.0 U	5.0 U	290.0 BR	22.4 U	1.5 B	2.0 U	6.4 B	+25.4	7.6 U	2.0 UW
	6/92(uf)	--	--	--	--	--	--	--	--	7.3	--	--
	6/92(f)	--	--	--	--	--	--	--	--	0.6 U	--	--
* EMG-3	08/22/91(uf)	5.0 U	5.0 U	5.0 U	10.0 U	17.7 U	2.5 B	2.0 U	10.3	7.5	3.0 U	2.0 U
EMG-5	08/21/91(uf)	0.7 J	5.0 U	5.0 U	10.0 U	16.4 U	+5.2	3.1 B	28.5	12.5	55.2	2.0 UW
	6/92(uf)	--	--	--	--	--	2.5 B	--	--	--	--	--
	6/92(f)	--	--	--	--	--	0.7 U	--	--	--	--	--
* EMG-6	08/20/91(uf)	5.0 U	5.0 U	5.0 U	10.0 U	+64.1	+10.7	6.4 U	69.6	10.5	48.6	2.0 U
	6/92(uf)	--	--	--	--	17.4 U	+27	--	51.5	--	--	--
	6/92(f)	--	--	--	--	17.4 U	0.7 U	--	4.6 U	--	--	--
* EMG-7	08/20/91(uf)	5.0 U	5.0 U	5.0 U	10.0 U	9.0 U	1.0 U	2.0 U	3.0 U	3.9	3.0 U	2.0 UW
	12/12/91(uf)	--	--	--	--	+54.7 B	1.7 B	2.0 U	40.3 J	11.3 S	17.0 U	1.0 UWNJ
	12/12/91(f)	--	--	--	--	+22.2 B	3.5 B	2.0 U	11.8 J	1.0 U	17.0 U	1.0 UWNJ
	6/92(uf)	--	--	--	--	17.4 U	--	--	--	--	--	--
	6/92(f)	--	--	--	--	17.4 U	--	--	--	--	--	--
* RW-1	08/16/91(uf)	40.0 B	5.0 U	5.0 U	20.0 U	32.1 U	1.0 U	2.3 U	22.0 U	1.6 U	9.9 U	2.0 U
* RW-2	12/11/91(uf)	10.0 U	10.0 U	10.0 U	10.0 U	--	--	--	--	--	--	--
	12/12/91(uf)	--	--	--	--	9.0 U	1.0 U	2.0 U	8.9 BJ	1.5 J	17.0 U	1.0 UWNJ
	12/12/91(f)	--	--	--	--	7.0 U	1.0 U	2.0 U	6.0 UJ	1.0 U	17.0 U	1.0 UWNJ
	6/92(uf)	--	--	--	--	17.4 U	--	--	--	--	--	--
	6/92(f)	--	--	--	--	17.4 U	--	--	--	--	--	--

TABLE 3-9
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS – ORGANIC/INORGANIC COMPOUNDS EXCEEDING MCLs/MCLGs
FORMER FIRESTONE FACILITY – ALBANY, GEORGIA (μg/l)

Chemical of Concern		1,1,1-TCA	1,1-DCE	Benzene	DEHP	Antimony	Beryllium	Cadmium	Chromium	Lead	Nickel	Thallium
MCL/MCLG		200/200	7/7	5/0	6/6	6/6	4/4	5/5	100/100	15/0	100/100	2/0.5
Upper Ocala Wells	Sampling Date											
* RW-3	08/21/91(uf)	0.9 J	5.0 U	5.0 U	10.0 U	20.1 U	+4.5 B	2.0 U	13.5	9.2	18.4 U	2.0 UW
	6/92(uf)	--	--	--	--	--	--	--	--	1.9 B	--	--
	6/92(f)	--	--	--	--	--	--	--	--	0.6 U	--	--
RW-4	09/17/91(uf)	5.0 U	5.0 U	5.0 U	4.0 BJ	7.0 U	1.0 U	2.0 U	16.1	1.1 B	17.0 U	1.0 B
	12/10/91(uf)	--	--	--	--	7.0 U	1.0 U	2.0 U	17.1 J	1.1 B	17.0 U	1.0 UNJ
	12/10/91(f)	--	--	--	--	7.0 U	1.0 U	2.0 U	6.0 UJ	1.0 U	17.0 U	1.0 UNJ
RW-5	09/23/91(uf)	0.5 J	0.3 J	5.0 U	10.0 U	7.0 U	1.0 U	2.0 U	9.3 B	1.0 UW	17.0 U	1.0 U
RW-6	09/30/91(uf)	5.0 U	5.0 U	5.0 U	10.0 U	15.2 U	1.0 U	2.0 U	7.6 B	2.2 B	17.0 U	1.0 UW
RW-7	09/26/91(uf)	5.0 U	5.0 U	5.0 U	10.0 U	13.5 U	1.0 U	2.0 U	13.1	3.8	17.0 U	1.0 UW
RW-8	09/20/91(uf)	5.0 U	1.0 U	5.0 U	10.0 U	7.0 U	1.0 U	2.0 U	28.6	2.7 B	17.0 U	1.0 B
RW-9	09/16/91(uf)	5.0 U	5.0 U	5.0 U	2.0 BJ	7.0 U	1.0 U	2.0 U	13.2	2.9 B	17.0 U	1.0 U
	12/11/91(uf)	--	--	--	--	7.0 U	1.0 U	2.0 U	6.0 J	1.0 U	17.0 U	1.0 UNJ
	12/11/91(f)	--	--	--	--	7.0 U	1.0 U	2.0 U	6.0 UJ	1.0 U	17.0 U	1.0 UNJ
DRW-2	08/29/91(uf)	5.0 U	1.0 J	5.0 U	10.0 U	9.0 U	1.0 U	2.0 U	4.3 U	2.1 B	3.0 U	2.0 U
DRW-3	08/29/91(uf)	5.0 U	5.0 U	5.0 U	10.0 U	14.3 U	1.0 U	2.0 U	3.0 U	1.6 B	3.0 U	2.0 UW
DRW-4	08/29/91(uf)	5.0 U	5.0 U	5.0 U	10.0 U	9.0 U	1.0 U	2.0 U	3.0 U	3.3	3.0 U	2.0 U
	09/26/91(uf)	--	--	--	10.0 U	--	--	--	--	--	--	--
DRW-8	10/01/91(uf)	5.0 U	5.0 U	5.0 U	10.0 U	16.1 U	1.0 U	2.0 U	11.8	4.6	17.0 U	1.0 U
^ RW-10	10/03/91(uf)	5.0 U	5.0 U	5.0 U	+170	+63	1.0 U	4.5 U	+105	8.9	19.0 B	1.0 UW
	12/10/91(uf)	--	--	--	--	+26.9 B	1.0 U	2.0 U	61.7 J	2.6 BS	17.0 U	1.0 UWNJ
	12/10/91(f)	--	--	--	--	+27.9 B	1.0 U	2.0 U	50.8 J	1.0 U	17.0 U	1.0 UWNJ
	6/92(uf)	--	--	--	--	17.4 U	1.2 B	1.7 U	23.5	1.0 B	6.5 U	0.6 U
	6/92(f)	--	--	--	--	17.4 U	1.2 B	1.7 U	25.8	0.6 U	6.5 U	0.6 U

TABLE 3-9
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS - ORGANIC/INORGANIC COMPOUNDS EXCEEDING MCLs/MCLGs
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA (μg/l)

Chemical of Concern		1,1,1-TCA	1,1-DCE	Benzene	DEHP	Antimony	Beryllium	Cadmium	Chromium	Lead	Nickel	Thallium
MCL/MCLG		200/200	7/7	5/0	6/6	6/6	4/4	5/5	100/100	15/0	100/100	2/0.5
Lower Ocala Wells	Sampling Date											
OW-1	08/26/91(uf)	10.0 U	10.0 U	10.0 U	4.0 BJ	9.0 U	1.0 U	2.0 U	3.0 U	6.1	3.0 U	2.0 UW
OW-2	09/04/91(uf)	6.0 U	6.0 U	6.0 U	+15.0 J	9.0 U	1.0 U	2.0 U	7.1 U	+61	11.9 U	2.0 U
	6/92(uf)	--	--	--	--	--	--	--	--	3.7	--	--
	6/92(f)	--	--	--	--	--	--	--	--	0.6 U	--	--
PW-1	10/01/91(uf)	0.5 U	0.5 U	0.5 U	10.0 U	26.0 U	1.0 U	3.0 U	+269	13.0	40.7	1.0 UW
	6/92(uf)	--	--	--	--	--	--	--	4.6 U	--	--	--
	6/92(f)	--	--	--	--	--	--	--	4.6 U	--	--	--
PW-2	09/27/91(uf)	0.5 U	0.5 U	0.5 U	10.0 U	7.6 U	1.0 U	2.0 U	6.0 U	1.0 UW	17.0 U	1.0 U
DRW-5	09/19/91(uf)	0.5 U	1.2	0.5 U	+19.0 J	7.0 U	1.0 U	2.0 U	34.5	+20.0	17.0 U	1.0 B
	12/10/91(uf)	--	--	--	--	3.0 U	1.1 B	5.0 U	42.6	+31.8 N	20.0 U	2.0 UW
	12/10/91(f)	--	--	--	--	3.0 UW	1.0 U	5.0 U	12.6	5.4 W	20.0 U	2.0 UW
	6/92(uf)	--	--	--	--	--	--	--	--	0.9 B	--	--
	6/92(f)	--	--	--	--	--	--	--	--	0.6 U	--	--
DRW-6A	09/19/91(uf)	0.5 U	0.5 U	0.5 U	2.0 J	7.0 U	1.0 U	2.0 U	12.5	9.3	17.0 U	1.0 U
DRW-7A	09/18/91(uf)	0.5 UJ	0.5 UJ	0.5 UJ	11.0 BR	7.0 U	1.0 U	2.0 U	22.4	6.1	17.0 U	1.0 B
DRW-9	09/20/91(uf)	0.5 U	0.5 U	0.5 U	10.0 U	7.0 U	1.0 U	2.0 U	18.1	1.0 U	17.0 U	1.0 U
DRW-10	09/18/91(uf)	0.5 U	0.5 U	0.5 U	3.0 BJ	8.9 U	1.0 U	2.0 U	12.7	6.8	17.0 U	1.0 U
	12/11/91(uf)	--	--	--	--	3.0 U	1.0 U	5.0 U	10.0 U	5.3 U	20.0 U	2.0 U
	12/11/91(f)	--	--	--	--	3.0 U	1.0 U	5.0 U	10.0 U	2.0 UW	20.0 U	2.0 U

TABLE 3-9
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS - ORGANIC/INORGANIC COMPOUNDS EXCEEDING MCLs/MCLGs
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA ($\mu g/l$)

Chemical of Concern		1,1,1-TCA	1,1-DCE	Benzene	DEHP	Antimony	Beryllium	Cadmium	Chromium	Lead	Nickel	Thallium
MCL/MCLG		200/200	7/7	5/0	6/6	6/6	4/4	5/5	100/100	15/0	100/100	2/0.5
Lower Ocala Wells	Sampling Date											
^ DRW-11	09/24/91(uf)	5.0 U	5.0 U	5.0 U	10.0 U	7.0 U	1.0 U	2.0 U	14.5	10.4	17.0 U	1.0 U
	09/27/91(uf)	--	--	--	10.0 U	7.0 U	1.0 U	2.0 U	+216	1.0 U	17.0 U	1.0 U
	12/10/91(uf)	--	--	--	--	3.0 U	1.0 U	5.0 U	13.0	2.0 UW	20.0 U	2.0 U
	12/10/91(f)	--	--	--	--	+6.8 B	1.0 U	5.0 U	10.0 U	2.0 UW	20.0 U	2.0 U
	6/92(uf)	--	--	--	--	17.4 U	0.7 U	1.5 U	10.3	0.9 B	4.9 B	0.6 U
	6/92(f)	--	--	--	--	17.4 U	0.7 U	1.5 U	7.4 B	0.6 U	3.0 U	0.6 U

Notes:
All concentrations presented in $\mu g/l$.
"*" Indicates well screen/sand pack straddles the Residuum and Upper Ocala Limestone.
"**" Indicates pre-RI sample result (January, 1991)
"^" Indicates background well.
(uf) indicates an unfiltered sample.
(f) indicates a filtered sample.
"+" Indicates concentration exceeds MCL.
"U" Indicates parameter undetected at the quantitiation limit presented.
"J" Indicates an estimated value.
"B" (organics) Indicates chemical found in method blank.
"R" (organics) Indicates result rejected during screening due to presence of chemicals found in method blank.
"B" (metals) Indicates an estimated value which is less than the CRDL; but greater than the IDL.
"S" Indicates a reported value determined by MSA.
"W" Indicates an estimated value because post-digestion spike was out of control limits.
"N" Indicates an estimated value because spike sample recovery was not within control limits.
"D" Indicates analysis performed on secondary dilution.
15 $\mu g/l$ is the current action level for lead.

TABLES\ALBANY\3-9

TABLE 3-10

AVERAGE LEAD AND BERYLLIUM CONCENTRATIONS USING MOST RECENT RESULTS FOR UNFILTERED GROUNDWATER SAMPLES
FORMER FIRESTONE FACILITY
ALBANY, GEORGIA

Residuum Well	Sampling Date	Lead
MW-1-2	12/12/91	7.2
MW-1-4	6/23/92	18.8
MW-7-8	8/15/81	8.2 U
MW-12-1	9/30/91	4.8 U
MW-12-1B	9/30/91	7.5
MW-14	6/22/92	2.1 B
BMW-3	6/10/92	1.2 B
BMW-4	8/22/91	6.6
EMG-5A	6/17/92	8.4
	Average:	6.7

Upper Ocala Well	Sampling Date	Beryllium
* MW-1-1	8/14/91	1.7 B
* MW-1-3	8/23/91	3.6 B
* MW-1-5	8/21/91	2.3 B
* MW-1-6	6/22/92	0.7 U
* MW-7-5	6/22/92	2.3 B
MW-13	10/1/92	1.0 U
* PTW-1	8/23/91	1.0 U
* EMG-1	8/20/91	2.5 B
* EMG-2	8/22/92	1.5 B
* EMG-3	8/22/92	2.5 B
EMG-5	6/17/92	2.5 B
* EMG-6	6/18/92	27
* EMG-7	12/1/91	1.7 B
* RW-1	8/16/91	1.0 U
* RW-2	12/12/91	1.0 U
* RW-3	8/21/91	4.5 B
RW-4	12/10/91	1.0 U
RW-5	9/23/91	1.0 U
RW-6	9/30/91	1.0 U
RW-7	9/26/91	1.0 U
RW-8	9/20/91	1.0 U
RW-9	12/11/91	1.0 U
DRW-2	8/29/91	1.0 U
DRW-3	8/29/91	1.0 U
DRW-4	8/29/91	1.0 U
DRW-8	10/1/91	1.0 U
	Average:	2.3

NOTES:
All concentrations in $\mu g/l$
"*" indicates well screen/sand pack straddles Residuum and Upper Ocala Limestone
"U" indicates parameter undetected at the quantitation limit presented
"B" indicates estimated value which is less than the contract required detection limit (CRDL), but greater than the instrument detection limit (IDL).
Average values calculated using concentrations equal to one-half of the quantitation limits for sample results listed as undetected (U).

TABLE 3-11
GROUNDWATER QUALITY DATA COMPARISON TO SECONDARY MAXIMUM CONTAMINANT LEVELS (SMCLs)
FORMER FIRESTONE FACILITY – ALBANY, GEORGIA (μg/l)

Chemical of Concern		Aluminum	Copper	Iron	Manganese	Silver	Zinc	pH	Total Dissolved Solids
SMCL		50-200	1000	300	50	100	5000	6.5-8.5	500,000
Residuum Wells	Sampling Date								
MW-1-2	08/14/91(uf)	3340	14.3 U	8830	46.6	4.1 U	30.2 UE	--	--
	12/12/91(uf)	2240 N*J	3.0 U	13400 U*J	53.8	2.0 U	32.5	6.3	74
	12/12/91(f)	11 UN*J	3.0 U	658 N*J	38.7	2.0 U	19.3 B	--	--
MW-1-4	01/24/91**								
	08/15/91(uf)	38500	111	61100	6140	8.3 U	174 E	5.2	--
MW-7-8	08/15/91(uf)	14500	25.0 U	48300	211	3.8 U	72.3 E	6.1	29
MW-12-1	08/17/91(uf)	2170	16.9 U	3470	70.4	5.2 U	53.9 E	5.7	--
	09/30/91(uf)	996	9.0 U	955	73.6	3.6 U	26.8	--	--
MW-12-1B	09/30/91(uf)	7930	19.1 U	15700	1280	4.2 U	59.9	5.0	--
MW-14	10/01/91(uf)	19500	231.0 U	71200	233	4.8 U	102	5.1	--
BMW-3	08/20/91(uf)	28600 N	20.6 B	57200	383	2.0 U	88.6	6.1	--
BMW-4	08/22/91(uf)	5960 N	8.2 B	19200	85.4	2.0 U	75.3	6.1	--
EMG-5A	08/21/91(uf)	23100 N	98.3	25300	213	2.0 U	515	5.4	--
^ BMW-2	08/17/91	101000	75.8 U	31700	561	6.6 U	134 E	--	--
	12/12/91(uf)	3340 N*J	3.0 U	8360 N*J	263	2.0 U	31.2	--	--
	12/12/91(f)	68.3 BN*J	3.0 U	6670 N*J	258	2.0 U	27.3	--	--
	6/92(uf)	1040	1.3 U	1750	157 B	1.4 U	22.1	--	--
	6/92(f)	46.3 B	1.3 U	1040	721 B	1.4 U	6.3 B	--	--
Maximum		101000	98.3	61100	6140	8.3U	515	6.3	74

TABLE 3-11
GROUNDWATER QUALITY DATA COMPARISON TO SECONDARY MAXIMUM CONTAMINANT LEVELS (SMCLs)
FORMER FIRESTONE FACILITY – ALBANY, GEORGIA (μg/l)

Chemical of Concern		Aluminum	Copper	Iron	Manganese	Silver	Zinc	pH	Total Dissolved Solids
SMCL		50-200	1000	300	50	100	5000	6.5-8.5	500,000
Upper Ocala Wells	Sampling Date								
* MW-1-1	08/14/91(uf)	10900	26.1 U	11800	1790	6.4 U	103 E	7.1	--
* MW-1-3	08/23/91(uf)	77200 N	980	92400	243	2.0 U	735	5.7	--
* MW-1-5	08/21/91(uf)	59100 N	76.0	84900	5640	2.0 U	371	7.4	--
* MW-1-6	09/05/91(uf)	84600	62.4	47900	1370	2.0 U	279	10.2	--
* MW-7-5	08/15/91(uf)	89000	193	106000	18600	11.1 U	1050 E	7.3	--
MW-13	10/01/91(uf)	42.6 U	7.7 U	251	9.4 B	4.8 U	42	11.3	--
* PTW-1	08/23/91(uf)	37.2 UN	41.4	12.9 B	12.0 B	2.0 U	124	6.1	--
* EMG-1	08/20/91(uf)	6290 N	15.4 B	17100	407	2.0 U	61.2	7.5	--
* EMG-2	08/22/91(uf)	2130 N	12.6 B	25.4	326	2.0 U	38	7.6	--
* EMG-3	08/22/91(uf)	5530 N	10.9 B	10500	552	2.0 U	39.8	7.1	--
EMG-5	08/21/91(uf)	8970 N	57.6	15700	992	2.0 U	470	7.1	--
* EMG-6	08/20/91(uf)	13000	44.0 U	18300	1280	4.2 U	169 E	7.0	--
* EMG-7	08/20/91(uf)	352 N	5.0 B	675	60.1	2.0 U	66	7.4	--
	12/12/91(uf)	3870 N*J	10.2 B	12700 N*J	391	2.0 U	31.4	--	--
	12/12/91(f)	35 BN*J	3.0 U	1240 N*J	1.5 B	2.0 U	9.5 B	--	--
* RW-1	08/16/91(uf)	585	10.5 U	1240	246	5.1 U	48.9 E	7.2	--
* RW-2	12/12/91(uf)	542 N*J	3.0 U	1990 N*J	110	2.0 U	23.4	--	--
	12/12/91(f)	24.7 BN*J	3.0 U	9.7 BN*J	1.0 U	2.0 U	5.2 B	--	--
* RW-3	08/21/91(uf)	10100 N	13.1 B	11100	1110	2.0 U	80.9	7.5	--
RW-4	09/17/91(uf)	7090	6.4 B	417	33.1	2.0 U	33.0 U	9.6	--
	12/10/91(uf)	2210 N*J	3.0 U	321 N*J	8.7 B	2.0 U	16.7 B	--	--
	12/10/91(f)	1880 N*J	3.0 U	24.9 BN*J	1.0 U	2.0 U	11.4 B	--	--
RW-5	09/23/91(uf)	843	6.7 B	302	12.4 B	2.0 U	102	8.5	--
RW-6	09/30/91(uf)	968	12.1 U	130	17.3	3.7 U	48.7	8.6	--

TABLE 3-11
GROUNDWATER QUALITY DATA COMPARISON TO SECONDARY MAXIMUM CONTAMINANT LEVELS (SMCLs)
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA (μg/l)

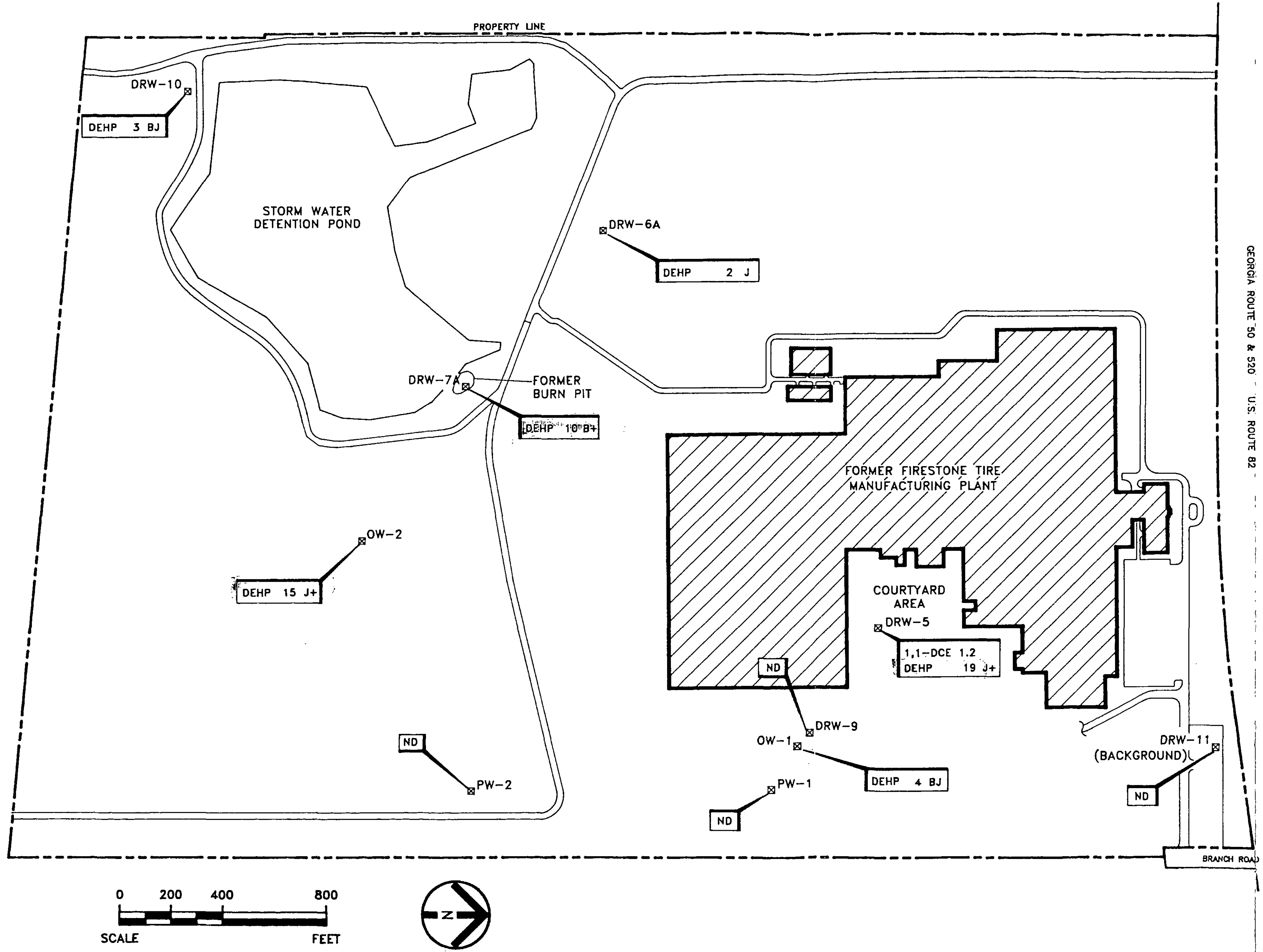
Chemical of Concern		Aluminum	Copper	Iron	Manganese	Silver	Zinc	pH	Total Dissolved Solids
SMCL		50-200	1000	300	50	100	5000	6.5-8.5	500,000
Upper Ocala Wells	Sampling Date								
RW-7	09/26/91(uf)	1200	12.5 U	1210	265	3.3 U	95.3	7.5	--
RW-8	09/20/91(uf)	369	3.0 U	658	89.9	2.0 U	67.8	7.0	--
RW-9	09/16/91(uf)	110 U	11.4 B	183	42.9	2.0 U	32.6 U	7.8	--
	12/11/91(uf)	56.8 BN*J	3.0 U	76.7 BN*J	15.3	2.0 U	10.1 B	--	--
	12/11/91(f)	31.9 BN*J	3.0 U	51.5 BN*J	13.9 B	2.0 U	3.1 B	--	--
DRW-2	08/29/91(uf)	807	2.8 U	129	6.2 B	2.0 U	25.1	11.2	--
DRW-3	08/29/91(uf)	93 UN	2.0 U	40.1 B	2.6 B	2.0 U	104	8.4	--
DRW-4	08/29/91(uf)	236 N	4.5 B	429	12.0 B	2.0 U	33.2	--	--
	09/26/91(uf)								
DRW-8	10/01/91(uf)	1070	8.8 U	636	30.9	5.1 U	186	7.7	--
	12/11/91								160
^ RW-10	10/03/91(uf)	2950	26.5	1390	65	4.8 U	87.6	12.1	
	12/10/91(uf)	2560 N*J	3.0 U	539 N	20.6	2.0 U	15.6 B	--	--
	12/10/91(f)	1840 N*J	3.0 U	86 BN*J	1.0 U	2.0 U	6.8 B	--	--
	6/92(uf)	2490	8.8 B	278	8.9 B	3.7 U	31.2	--	--
	6/92(f)	2510	3.7 B	23.8 B	1.9 B	2.2 B	23.6	--	--
Maximum		89000	980	106000	18600	2.2B	1050	12.1	160
Lower Ocala Wells	Sampling Date								
OW-1	08/26/91(uf)	48.3 UN	7.1 B	2370	35.2	2.0 U	49.9	7.5	--
OW-2	09/04/91(uf)	60.6 B	33.8	25200	183	2.0 U	427	6.6	--
PW-1	10/01/91(uf)	775	35.6	705	17.6	6.7 U	98.6	7.5	--
PW-2	09/27/91(uf)	18.4 U	5.7 U	4.0 U	1.1 U	2.0 U	20.1	6.2	--

TABLE 3-11
GROUNDWATER QUALITY DATA COMPARISON TO SECONDARY MAXIMUM CONTAMINANT LEVELS (SMCLs)
FORMER FIRESTONE FACILITY – ALBANY, GEORGIA (μg/l)

Chemical of Concern		Aluminum	Copper	Iron	Manganese	Silver	Zinc	pH	Total Dissolved Solids
SMCL		50-200	1000	300	50	100	5000	6.5-8.5	500,000
Lower Ocala Wells	Sampling Date								
DRW-5	09/19/91(uf)	8120	13.7 B	2760	172	2.0 U	279	11	--
	12/10/91(uf)	10600	38.7	4400	202	5.0 U	73.2	11	150
	12/10/91(f)	661	16.4 B	382	119	5.0 U	52.4	--	--
DRW-6A	09/19/91(uf)	2830	7.0 B	1880	62	2.0 U	423	7.5	--
DRW-7A	09/18/91(uf)	1340	15.1 B	1060	37.3	2.0 U	693	7.4	--
DRW-9	09/20/91(uf)	4540	8.3 B	2170	92.9	2.0 U	163	9.3	--
DRW-10	09/18/91(uf)	517	16.4 B	1400	27.2	2.0 U	89.4	8.3	--
	12/11/91(uf)	114 B	10.0 U	94.2 B	4.2 B	5.0 U	16.7 B	--	--
	12/11/91(f)	40.0 U	11.4 B	10.0 U	2.3 B	5.0 U	11.2 B	--	--
^ DRW-11	09/24/91(uf)	4650	23.5 B	2320	55.7	2.0 U	472	8.8	--
	09/27/91(uf)	777	22.4 U	437	7.1 B	2.0 U	67	--	--
	12/10/91(uf)	221	10.0 U	56.8 B	3.0 B	5.0 U	11.5 B	--	--
	12/10/91(f)	53.8 B	10.0 U	10.2 B	2.0 U	5.0 U	11.5 B	--	--
	6/92(uf)	139	2.6 B	112	3.1 B	1.4 U	18.4 B	--	--
	6/92(f)	37.2	1.4 B	5.1 B	1.2 B	1.4 U	14.1 B	--	--
Maximum		10600	38.7	25200	202	6.7U	693	11	150

Notes:
All concentrations presented in μg/l.
"*" Indicates well screen/sand pack straddles the Residuum and Upper Ocala Limestone.
"**" Indicates pre-RI sample result (January, 1991)
"^" Indicates background well.
(uf) indicates an unfiltered sample.
(f) indicates a filtered sample.
"U" Indicates parameter undetected at the quantitiation limit presented.
"J" Indicates an estimated value.
"B" Indicates an estimated value which is less than the CRDL; but greater than the IDL.
"N" Indicates an estimated value because spike sample recovery was not within control limits.

Figures



LEGEND

⊠ LOWER OCALA LIMESTONE WELL

15 ANALYTICAL RESULTS REPORTED IN ug/l

ND CHEMICALS NOT DETECTED

\+ CONCENTRATION EXCEEDS REMEDIATION GOALS

CHEMICALS IDENTIFIED

1,1-DCE 1,1-DICHLOROETHENE

DEHP DI(2-ETHYLHEXYL)PHTHALATE

J = THE VALUE IS AN ESTIMATED CONCENTRATION, OFTEN APPLIED WHEN THE CHEMICAL IS DETECTED BETWEEN THE CONTRACT-REQUIRED LIMIT (CDRL) AND THE INSTRUMENT DETECTION LIMIT (IDL)

D = ANALYSES OF THE SAMPLE WAS BASED UPON A SECONDARY DILUTION OF THE SAMPLE

B = THE CHEMICAL WAS DETECTED IN AN ASSOCIATED BLANK SAMPLE.

Woodward-Clyde Consultants
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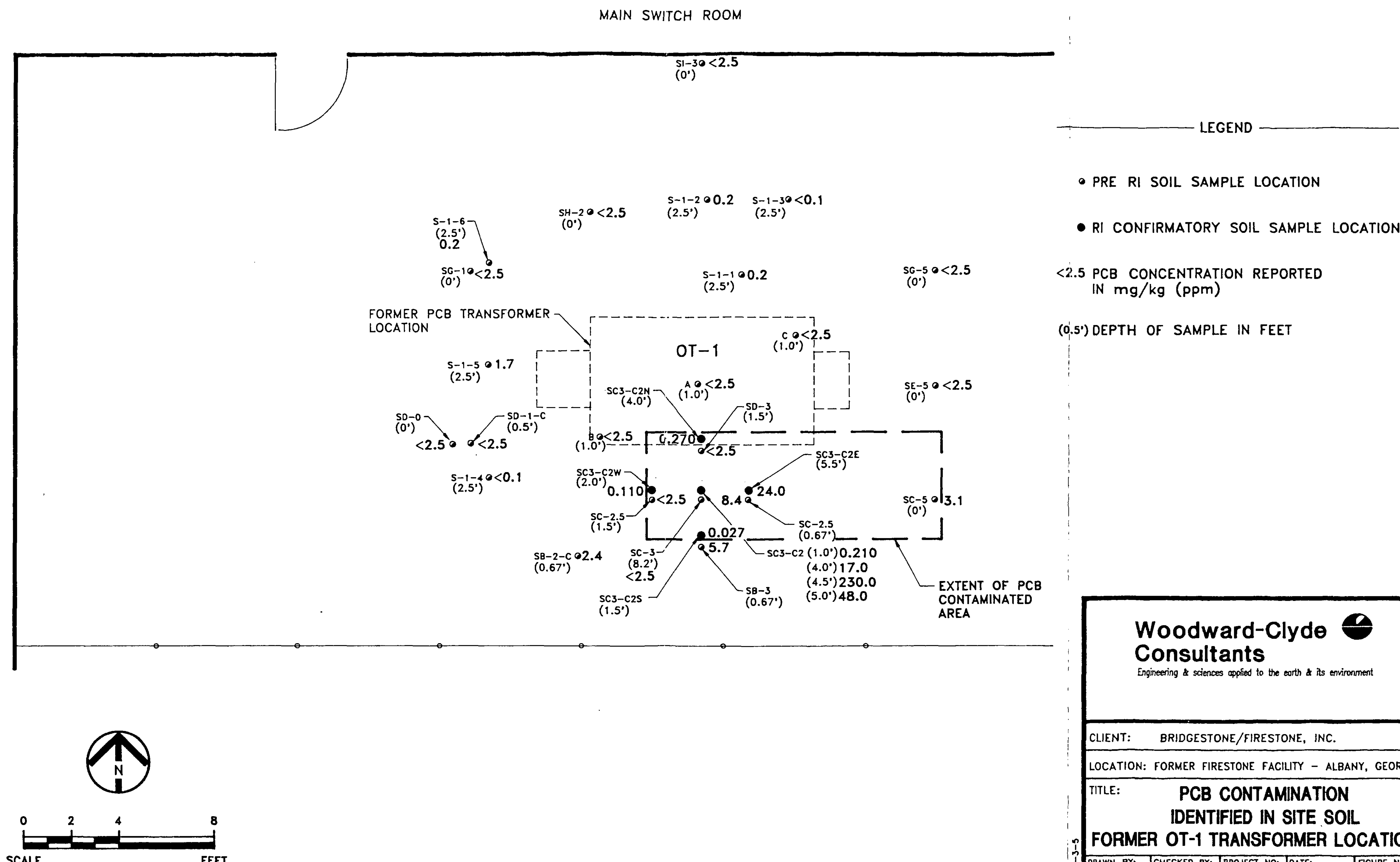
CLIENT: BRIDGESTONE/FIRESTONE, INC.

PROJECT: FORMER FIRESTONE FACILITY RI/FS - ALBANY, GEORGIA

TITLE: ANALYTICAL RESULTS FOR CHEMICALS TO BE REMEDIATED IN LOWER OCALA WELLS

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
LM	REM	90C6116	7-30-92	3-4

8116-348



Woodward-Clyde Consultants
Engineering & sciences applied to the earth & its environment

CLIENT:	BRIDGESTONE/FIRESTONE, INC.
LOCATION:	FORMER FIRESTONE FACILITY – ALBANY, GEORGIA
TITLE:	PCB CONTAMINATION IDENTIFIED IN SITE SOIL FORMER OT-1 TRANSFORMER LOCATION

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
REM	MJM	90C6116	5-15-92	3-5

6116-3-5

4.0
TECHNOLOGY AND PROCESS OPTION SCREENING

This section presents the five initial screening activities used to identify the potential remedial action alternatives for the site. The activities consist of:

- Development of General Response Actions
- Identification of Remedial Technologies and Process Options
- Screening of Remedial Technologies and Process Options
- Evaluation of Process Options based on Effectiveness, Implementability, and Cost
- Selection of Remedial Technologies and Process Options

4.1 DEVELOPMENT OF GENERAL RESPONSE ACTIONS

The FS process involves the development of general response actions, followed by identification, screening, and selection of remedial technologies. The general response actions are broad classes of actions or remedies that will satisfy the remediation goals. Available technologies and process options that correspond to the general response actions are identified and screened in Section 4.2. The remedial alternatives presented in Section 5.0 identify combinations of general response actions that may be applicable to the site. The following general response actions have been identified for both the groundwater and soil at the site.

- No Action, which consists of leaving the site "as is," with no provisions being made for monitoring, control, or cleanup of the contamination.

- Institutional Controls, which involve the creation and implementation of responsibilities for restricting public and environmental contact with the contaminants.

- Containment, which involves physical restrictions on contaminant mobility and water infiltration.

- Extraction or Removal, which involves the direct physical removal of the contamination or contaminant sources.

- Treatment, which involves on-site and/or off-site measures to reduce toxicity, mobility, and volume of the contaminated materials.

- Discharge or Disposal, which involves measures to relocate contaminants in such a way as to reduce their interaction with the public and the environment.

4.2 CANDIDATE TECHNOLOGIES AND PROCESS OPTIONS

A master list of potentially applicable treatment technologies and process options within each technology for the two media of interest (groundwater and soil) was prepared. The term "remedial technology" refers to general categories of technology types, such as biological treatment, chemical treatment, and thermal destruction. The term "process option" refers to specific processes within each technology category. For example, under the technology category of biological treatment, there may be aerobic and anaerobic treatment process options. The technologies and process options considered applicable to the site were assembled after review of:

- U.S. EPA documents

- Pertinent textbooks, technical journals and seminar/conference proceedings

- Information provided by remediation contractors

- WCC's past experience in the hazardous waste remediation area

Some of the key documents used in this review were:

- Remedial Action at Waste Disposal Sites Handbook (U.S. EPA, 1985)
- Technology Screening Guide for Treatment of CERCLA Soils and Sludges (U.S. EPA, 1988b)
- Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites (U.S. EPA, 1988d)
- Standard Handbook of Hazardous Waste Treatment and Disposal (Freeman, 1989)
- Groundwater Treatment Technology (Nyer, 1985)

Tables 4-1 and 4-5 list the potential treatment technologies and corresponding process options for groundwater and soil, respectively. The technologies and process options listed in these tables were selected based on the fate and transport characteristics of the chemicals of concern identified in the different media and on the applicability of a given technology or process option to a specific medium.

4.3 SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS

The remedial technologies and process options for groundwater and soil identified in Tables 4-1 and 4-5 were first screened on the basis of technical implementability in accordance with the RI/FS Guidance Document.

The technologies and the process options that cannot be effectively implemented at the Site were screened out by using the information currently available from the RI Report (WCC, 1992b) characterization, such as contaminant types, contaminant concentrations, and site characteristics.

Tables 4-2 and 4-6 describe the process options, present initial screening comments, and summarize the technology screening process for the groundwater and soil process options, respectively. A description of each process option is included in each table to provide an understanding of each option and to assist in the evaluation of its technical implementability. The screening comments address the technical feasibility and the ability of a given process option to serve its intended purpose. The screening comments include a statement as to whether each process option was determined to be potentially applicable or was rejected.

4.4 EVALUATION OF PROCESS OPTIONS BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST

The process options that were retained for evaluation during the initial screening are evaluated in greater detail in this section. The three evaluation criteria are effectiveness, implementability, and cost, in accordance with the RI/FS Guidance Document. Process options were evaluated on their effectiveness relative to other options within the same technology type. This evaluation focused on three primary considerations:

- The potential effectiveness of process options in handling each medium and meeting the goals identified in the general response actions

- The effectiveness of the process options in protecting human health and the environment during the construction and implementation phases

- The proven track record and the reliability of the process options with respect to the contaminants and conditions at the site.

The implementability evaluation includes consideration of both the technical and the administrative feasibility of implementing a particular process option.

The cost evaluation includes a qualitative estimation of the relative capital and operation and maintenance (O&M) costs associated with the process options. As noted in the

RI/FS Guidance Document, the greatest cost variability during site remediation is generally seen among the technology types, rather than among specific process options in a given technology.

The evaluation of the process options based on effectiveness, implementability, and cost is summarized in Tables 4-3 and 4-7 for groundwater and soil, respectively. Those process options that were retained after the evaluation were used in the development of the remedial alternatives presented in Section 5.0.

4.5 RETAINED TECHNOLOGIES AND PROCESS OPTIONS FOR GROUNDWATER

The technologies and process options which were retained after the above screening and evaluation are summarized in this section. Table 4-4 provides a list of retained process options for groundwater. The following sections describe the retained process options in greater detail. The retained process options are assembled into alternatives in Section 5.0.

4.5.1 No Action

In accordance with the NCP, a no action alternative is required for consideration to serve as a baseline against which the other technologies can be compared. No land use restrictions would be implemented, and no containment treatment would be performed.

4.5.2 Groundwater Monitoring

This option would involve periodic and continued monitoring of the groundwater to detect any changes in the migration of contaminants. Capital expenditures would be associated with the installation of any additional monitoring wells. Cost of O&M would depend on the frequency of sampling and the number and types of parameters analyzed.

4.5.3 Deed Restrictions

Deed restrictions would involve restricting or prohibiting the installation of new water supply wells in the manufacturing area. By prohibiting the installation of new wells, the potential for cross-contamination of the lower groundwater zones and an increased hydraulic gradient are prevented. Deed restrictions should be relatively easy to implement and would result in relatively low capital costs.

4.5.4 Drainage Controls

Drainage controls such as diversion channels, dikes, or regrading would be used to control surface water run-off in areas of concern. The increase in surface water run-off would decrease infiltration through soils and potentially decrease migration of contaminants from the soil to the groundwater. Drainage controls would be easily implemented at the site and would be effective in protecting human health and the environment when used in conjunction with other remedial technologies. The cost of implementing drainage controls would be relatively low, and O&M costs would be minimal.

4.5.5 Asphalt Cap

An asphalt cap would reduce the infiltration of surface water and potential for migration of contaminants. The asphalt cap would be installed over areas of concern using conventional paving methods. Grading, drainage controls and revegetation would provide additional protection from infiltration and damage to the cap. This type of cap would require periodic maintenance to preserve its integrity. Construction of a cap may be difficult in the courtyard area due to the existing structures and utilities. Costs for the asphalt cap would be dependent on the surface area to be covered, but are generally moderate.

4.5.6 Extraction Wells

Extraction wells would be an effective method of removing contaminated groundwater for above-ground treatment and reducing contaminant migration. Existing monitoring wells could be converted to extraction wells. Implementation would be relatively easy using conventional techniques and materials. Two wells of the courtyard area wells (PTW-1 and MW-1-3) are currently being used to extract groundwater. Costs for each extraction well would be relatively low, but the total cost would depend on the number of wells required and the extent of the piping system required to transfer the water for treatment.

4.5.7 Physical/Chemical Treatment

Representative processes that have been selected for treatment of groundwater are: precipitation, flocculation/sedimentation, filtration, and air stripping. The first three listed are pretreatments or polishing options for solids removal. Air stripping was retained as the primary treatment technologies for removal of VOCs from groundwater. Vapor-phase granular activated carbon (GAC) would be used to control the release of VOCs to air from an air stripping system. These options were selected based on their effectiveness with respect to site conditions and cost.

4.5.7.1 Precipitation

Precipitation is a process through which a substance in solution is transformed into a solid phase. The chemical equilibrium would be altered in order to affect the solubility of the substance in solution. The particles can be removed from the liquid phase by settling in a sedimentation chamber or by filtration.

Precipitation would be utilized as a pretreatment or polishing step in conjunction with another treatment process, rather than as a primary treatment. The process is readily available and easily implementable. Some treatability testing would be required to determine design considerations. Cost of this process option would be moderate with respect to both capital and O&M.

4.5.7.2 Flocculation/Sedimentation

Flocculation/sedimentation is a process where small, suspended particles would be transformed into larger, settleable particles by the addition of chemicals. The larger particles would settle under the force of gravity. Flocculation would be induced through the use of a flocculating agent such as alum, lime, or one of various iron salts. The "floc" particles can be removed from the liquid by sedimentation. This process option is an effective method for removing particles from liquid, provided that there is a significant density difference between the suspended matter and the liquid.

Flocculation/sedimentation would be utilized as a pretreatment or polishing step, in conjunction with another treatment process, rather than as a primary treatment. The process is readily available and easily implementable, requiring only chemical pumps, metering devices, and mixing and settling tanks. Some treatability testing would be required to determine design considerations. Cost of this process option would be moderate with respect to both capital and O&M.

4.5.7.3 Filtration

Filtration is a method for removing suspended particles from a fluid by passing the liquid through a porous medium. The porous medium can consist of a fibrous fabric, screen or granular material, depending on the nature of the substance to be treated. This treatment would be used as a pre- or post-treatment technology in conjunction with other treatment options. Filtration is an effective means of removing suspended particles from water, though it is not effective for the removal of dissolved substances. A filtration system would be easily implemented, requiring pilot testing for design considerations. Capital costs would be low, and O&M costs would be low to moderate.

4.5.7.4 Air Stripping

Air stripping is a process which facilitates the mass transfer of volatile compounds from a liquid phase to a gas phase. Air stripping could be achieved using the existing collection/aeration tank. Air enters the bottom of the tank and flows upward through the water. The air stripping process may also consist of a packed bed tower where groundwater enters the top of the tower and is distributed over structural packing material. Air is blown up the tower. Volatile components in water will preferentially volatilize and be removed from the water. This process is a proven and effective method of removing volatile organics from aqueous waste streams, including those that contain multiple volatile organic compounds. The cost of an air stripping system is typically low in comparison to other VOC removal technologies. O&M costs would depend on the size of the system and the design removal efficiencies. Water containing suspended solids or high concentrations of dissolved solids must be treated prior to aeration. Additional O&M costs may be incurred if polishing of the water effluent or treatment of the off-gasses are required.

4.5.7.5 Granular Activated Carbon (GAC) Adsorption

GAC adsorption is a process in which contaminated liquid or vapor passes through vessels containing activated carbon. When the carbon reaches its maximum adsorption it would be replaced with fresh carbon. Regular effluent sampling would be necessary to determine whether the carbon beds have been exhausted. Monitoring of contaminant breakthrough and buildup of suspended solids would be necessary. Dissolved and suspended solids may need to be removed from groundwater prior to GAC treatment in order to avoid buildup in the filters.

The GAC technology is reliable and readily available. A treatability study has been performed for the site and indicates that GAC would effectively remove VOCs from the groundwater or vapor discharge (WCC, 1992c). However, the adsorption capacity of vapor-phase GAC is significantly reduced when the relative humidity of the air is greater than 50 percent. The humidity can be reduced most easily by heating the air prior to entering the GAC bed. Based on the results of the treatability study, the use of aqueous-phase GAC adsorption for removal of VOCs from the groundwater was retained as a potential process option. The use of vapor-phase GAC as a method to treat vapors as a polishing step was retained for use in conjunction with air stripping. Costs for installation and operation of an aqueous or vapor-phase GAC system would be moderate.

4.5.8 Discharge to Off-site POTW

Extracted and treated groundwater would be discharged to the POTW through the existing on-site sanitary sewer system. This option can be used with any extraction and treatment process selected. The POTW is an effective means of disposing of treated water, though the discharged water would have to meet local effluent requirements. Discharge to the POTW has already been implemented under the interim remedial measures. Capital costs would be low to moderate while O&M costs would be moderate.

4.6 RETAINED TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL

The technologies and process options for soil that were retained after the above screening and evaluation are summarized in this section. Table 4-8 provides a list of retained process options for soil. The following sections describe the retained process options in greater detail. The retained process options are assembled into alternatives in Section 5.0.

4.6.1 No Action

In accordance with the NCP, a no action alternative is required for consideration to serve as a baseline against which the other technologies can be compared. No land use restrictions would be implemented, and no containment or treatment would be performed.

4.6.2 Institutional Controls

Three options were retained as institutional controls: deed restrictions, fencing, and groundwater monitoring. These options are described below in more detail.

4.6.2.1 Deed Restrictions

All property with contaminated soil would have restrictions concerning present and future land use placed on deeds. Deed restrictions may be implemented at would relatively low capital costs, but may impact current and future facility operations and expansions.

4.6.2.2 Fencing

Contaminated areas would be surrounded with a fence to control access. This process would be easily implemented at a low cost, but may impact current and future facility operations and expansions.

4.6.2.3 Groundwater Monitoring

Groundwater monitoring would be used to evaluate the migration of contamination to the groundwater. This option would be used in conjunction with a containment option where contamination is left on site. This is an effective and reliable method of monitoring groundwater. Capital costs would be dependent on the number of wells required, but are expected to be low, and low O&M costs would be incurred through continued collection and analysis of groundwater.

4.6.3 Drainage Controls

Drainage controls such as diversion channels, dikes, or regrading would be utilized to control surface water run off in areas of concern. The increase in surface water run-off would decrease infiltration and potentially decrease migration of contaminants from the soil to the groundwater. The cost of implementing drainage controls would be relatively low while O&M costs would be minimal.

4.6.4 Asphalt Cap

An asphalt cap would reduce the infiltration of surface water and potential for migration of contaminants. The asphalt cap would be installed over areas of concern using conventional paving methods. Grading and drainage controls would provide additional protection from infiltration and damage to the cap. This type of cap would require periodic maintenance to preserve its integrity. Construction of a cap may be difficult in the courtyard area due to the existing structures and utilities. However, an asphalt cap is expected to be the easiest to install and maintain. Costs for the asphalt cap would be dependent on the surface area to be covered, but are generally moderate and are lower than concrete.

4.6.5 Solvent Extraction

The solvent extraction process has been retained as the representative form of on-site treatment and involves adding solvents to excavated soil to separate the contaminants from the soil. Following the extraction, solids would be separated from the solvent, which will contain the concentrated contaminants. The solvent and concentrated contaminant residuals would be disposed off site. This process is a proven and reliable method for removing contaminants from soil. Due to the low permeability of the soil, several extractions may be required. Treatability testing would be required to determine the nature of the solvents required and the percent of contaminant reduction. The cost of the solvent extraction is expected to be high for the small volume of soil anticipated to be treated. No O&M costs would be incurred.

4.6.6 Mechanical Excavation

Excavation would be accomplished by using conventional earth-moving equipment. As the site is readily accessible, backhoes or front end-loaders could easily be used to excavate the contaminated soil. Since the area of contamination is relatively small, this technology would be an effective means of soil removal. The primary advantage of mechanical excavation would be the physical removal of the contaminated soil. This technology is readily implementable, incurring relatively low costs.

4.6.7 Off-Site Disposal

4.6.7.1 Incineration

Wastes would be transported to an off-site, permitted incineration facility for disposal. Contaminants would be subject to high temperatures to reduce the contaminants to basic components. This is an effective method for removal of contaminants from the site. Although cost-prohibitive for disposal of soil, this option has been retained for use in disposal of treatment wastes. Capital costs would be moderate to high, and no O&M costs would be incurred.

4.6.7.2 Permitted Landfill

Following removal, soil would be transported to an off-site permitted landfill for disposal. This option is an effective means of removing contamination from the site. Landfill disposal would be easily implemented. The cost of disposal would be dependent on the volume of soil to be disposed and the distance to the landfill, but would tend to be moderate in comparison to the relatively high cost of off-site incineration. No O&M costs would be incurred.

4.6.8 On-Site Placement of Treated Soils

Following removal, treated soil would be placed in a designated area on site. Placement of the treated soils would be easily implemented provided that PCB concentrations are reduced to less than 2 mg/kg. Costs for on-site disposal would be less than for off-site disposal at a permitted landfill.

Tables

TABLE 4-1
SUMMARY OF POTENTIAL REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR GROUNDWATER
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action	Remedial Technology	Process Option
No Action	None	None
Institutional Controls	Monitoring	Groundwater
	Groundwater Use Restrictions	Deed restrictions, reasonable use
Containment	Vertical Barriers	Slurry wall, grout curtain, sheet piling, vibrating beam, chemical grouting, rock grouting
	Horizontal Barriers	Block displacement
	Hydraulic Barriers/ Gradient Controls	French drain, extraction wells, reinjection wells
	Surface Controls	Drainage controls, revegetation
	Capping	Clay, clay/synthetic membrane, asphalt, concrete, multilayer, chemical sealants/stabilizers
Collection	Extraction	Extraction wells, subsurface pipe drains, French drain, well points, high-powered vacuum
Treatment	Physical/Chemical	Evaporative ponds, spray evaporation, precipitation, flocculation/sedimentation, centrifugation, dissolved air flotation, distillation, filtration, air stripping, liquid/liquid extraction, granular activated carbon (GAC) adsorption, ion exchange, reverse osmosis/ultrafiltration, oxidation/ultraviolet photolysis, chemical oxidation, chemical dehalogenation, neutralization
	Biological	Aerobic digestion, anaerobic digestion, Powdered Activated Carbon Treatment (PACT)
	Thermal Destruction	Incineration, wet air oxidation
	Off-site	POTW, RCRA treatment facility
	In-situ	Permeable treatment bed, bioremediation, aeration, neutralization, oxidation, polymerization
Disposal	Discharge	Deep well injection, recharge pond/trench, stream or creek, off-site POTW, reinjection wells
	Reuse	Industrial, agricultural

TABLE 4-2
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR GROUNDWATER
FORMER FIRESTONE FACILITY – ALBANY, GEORGIA

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
No Action	None	None	Site conditions would remain unchanged.	A no action alternative is required to be considered by NCP.
Institutional Controls	Monitoring	Groundwater	Periodic monitoring of groundwater would be conducted to determine the contaminant concentrations and migration direction.	Potentially Applicable
	Groundwater Use Restrictions	Deed Restrictions	Property over areas of influence would have restrictions concerning groundwater usage placed on the deeds.	Potentially Applicable
		Reasonable Use	Courts would place reasonable limits on the use and withdrawal of groundwater from property over areas of influence.	Potentially Applicable
Containment	Vertical Barriers	Slurry Wall	A soil-bentonite or soil-cement slurry would be pumped into an excavated trench and used to create a wall of low permeability.	Reject: Not an effective method of containment due to primarily vertical groundwater flow in the Residuum and Upper Ocala Limestone and the approximately 260 ft. depth to a confining layer.
		Grout Curtain	Grout would be injected or mixed into soil with auger-like blades to create a wall of low permeability.	Reject: Not an effective method of containment due to primarily vertical groundwater flow in the Residuum and Upper Ocala Limestone and the approximately 260 ft. depth to a confining layer.

TABLE 4-2
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR GROUNDWATER
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Containment (continued)	Horizontal Barriers	Block Displacement	After contaminated areas were isolated by a vertical barrier, grout would be injected through holes bored through contaminated area. Continued grout pumping would cause displacement of the contaminated block of the earth.	Reject: New, unproven technology, may be difficult to determine integrity; site conditions prohibit isolation of contaminated area with vertical barrier. Rock highly weathered with extensive jointing to restrict control of horizontal grout.
	Hydraulic Barriers/ Gradient Controls	French Drain	A trench backfilled with gravel would be used to control the groundwater gradient and reduce groundwater flow through contaminant source areas.	Reject: Not an effective method of containment due to primarily vertical groundwater flow in the Residuum and Upper Ocala Limestone and the approximately 260 ft. depth to a confining layer.
		Extraction Wells	Extraction wells would be pumped at a rate just high enough to change groundwater gradient, thus creating a hydraulic barrier to contaminant migration. Could be used in combination with reinjection wells.	Reject: Extraction from locations outside of contaminated area would not be effective due to primarily vertical groundwater flow in the Residuum and Upper Ocala Limestone.
		Injection Wells	A series of wells would be used to inject uncontaminated water into the aquifer in order to alter groundwater flow direction and create a barrier to contaminated groundwater flow. Could be used in combination with extraction wells.	Reject: Not feasible due to heterogeneity of the Residuum and Ocala Limestone.
	Surface Controls	Drainage Controls	New drainage patterns would be established to minimize infiltration in areas of contaminated soil.	Potentially Applicable: Used in conjunction with capping technology to control surface water migration through contaminated soil.
		Revegetation	A vegetative cover would be re-established in areas that have been regraded or capped to reduce erosion and increase integrity of other control measures.	Potentially Applicable: May be used in conjunction with some capping technologies.

TABLE 4-2
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR GROUNDWATER
FORMER FIRESTONE FACILITY – ALBANY, GEORGIA

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Containment (continued)	Capping	Clay	Compacted clay would be placed over contaminated area to reduce contaminant leaching as a result of surface water infiltration.	Potentially Applicable: May decrease infiltration of rainwater through contaminated soil.
		Synthetic Membrane	A synthetic membrane would be placed over areas of contamination to reduce contaminant leaching as a result of surface infiltration.	Potentially Applicable: May decrease infiltration of rainwater through contaminated soil.
		Asphalt	Contaminated soil would be covered with asphalt pavement to reduce surface water infiltration.	Potentially Applicable: May decrease infiltration of rainwater through contaminated soil.
		Concrete	Concrete slab would be installed over contaminated areas.	Potentially Applicable: May decrease infiltration of rainwater through contaminated soil.
		Multilayer	Contaminated material would be covered with a cap consisting of a three layer system conforming to RCRA regulations.	Potentially Applicable: May decrease infiltration of rainwater through contaminated soil. Layering would provide additional protection from infiltration. Would be effective in reducing surface water infiltration.
		Chemical Sealants/ Stabilizers	Water-dispersal emulsions or resins would be placed over contaminated areas to form a crust that would reduce water, wind, or dust erosion. Most emulsions are non-toxic to plant and animals.	Reject: Long term reliability is unproven, may be subject to damage by ultra-violet light and water.

TABLE 4-2
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR GROUNDWATER
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action	Remedial Technology	*Process Option*	*Description*	*Screening Comments*
Collection (continued)	Extraction	Extraction Wells	Contaminated groundwater would be extracted by pumping from wells to establish a zone of capture, which would trap contaminated groundwater and prevent migration of contaminants.	Potentially Applicable: Extensive pumping time is likely to be required due to relatively low hydraulic conductivity of Residuum and Upper Ocala limestone.
		Subsurface Pipe Drains	A system of subsurface perforated pipe drains would be used to collect contaminated groundwater.	Potentially Applicable: Trenching not feasible. Horizontal boring would be required for installation due to contaminant depth and proximity to building.
		French Drain	A trench backfilled with gravel and drain would be used for subsurface drainage of groundwater.	Reject: Not feasible due to depth required and proximity to building.
		Well Points	A group of closely spaced wells connected to a header would be used to extract contaminated groundwater. A suction pump would be used with well points.	Reject: Process limited to 20-25 feet; site would require pumping from greater depths.
Treatment	Physical/Chemical	Evaporative Ponds	Shallow ponds would be used to allow natural evaporation of water to occur.	Potentially Applicable: May require Best Available Control Technology (BACT) to control air emissions.
		Spray Evaporation	Contaminated groundwater would be sprayed in a fine mist to promote evaporation.	Potentially Applicable: May require Best Available Control Technology (BACT) to control air emissions.
		Precipitation	A physiochemical process based on altering the chemical equilibrium relationships affecting the solubility of organic species	Potentially Applicable

TABLE 4-2
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR GROUNDWATER
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Treatment (continued)	Physical/Chemical (continued)	Flocculation/ Sedimentation	Small suspended particles would be transformed into larger settleable particles by the addition of chemicals and would settle under the forces of gravity.	Potentially Applicable: Applicable for removal of suspended solids. Not applicable to organic compounds.
		Centrifugation	Stable, colloidal particles would be removed by the centrifugal forces created by high-speed rotation in a cylindrical vessel.	Reject: Not applicable to dilute concentrations.
		Dissolved Air Flotation	Air would be dissolved in a water stream under high pressure. The air would form a rising, fine-bubble carrier medium when the stream was depressurized in a separation chamber. The bubble medium would carry suspended solids or emulsified oil particles to surface for removal.	Reject: Not suitable for removal of dissolved contaminants.
		Distillation	Organic liquid waste would be heated to release volatile organic compounds into vapor phase. The vapor phase would be condensed and then treated or disposed.	Reject: Not effective for dilute contaminant concentrations. Primarily applicable to recovery of concentrated waste streams of spent organic solvents.
		Filtration	Would remove suspended particles by passing the waste stream through a porous medium. The porous medium could be a fibrous fabric, screen, or granular material.	Potentially Applicable: Will not remove dissolved substances; may be used in conjunction with other technologies.
		Air Stripping	The mixing of large volumes of air with contaminated water to promote the transfer of VOCs to air.	Potentially Applicable: Effective treatment for VOCs.
		Liquid/ Liquid Extraction	Two liquids which are mutually soluble may be separated by adding a third liquid which is a solvent for one of the original components but insoluble in and immiscible with the other.	Reject: Not applicable to water with multiple contaminants.

TABLE 4-2
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR GROUNDWATER
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Treatment (continued)	Physical/Chemical (continued)	Granular Activated Carbon (GAC) Adsorption	Molecular or colloidal materials would physically adsorb to the active porous surfaces of carbon. Spent carbon would be regenerated or disposed.	Potentially Applicable: Effective treatment for removal of organics and some inorganics from groundwater. Vapor-phase GAC can be used to control the release of VOCs to air from air stripper.
		Ion Exchange	Contaminated water is passed through a resin bed where ions are exchanged between resin and water.	Potentially Applicable: Primarily used for recovering metals. Not effective for organics, requires pretreatment.
		Reverse Osmosis/ Ultra-filtration	Transport of a contaminant from the contaminated medium across a semi-permeable membrane.	Potentially Applicable: Primarily used for recovering metals. Not effective for organics.
		Chemical Oxidation	Oxidation of organic compounds by the addition of chemicals (e.g., chlorine, ozone, hydrogen peroxide).	Potentially Applicable: Widely used in industrial water treatment.
		Oxidation/ Ultraviolet Photolysis	Oxidation of organic compounds by addition of chemicals (e.g., chlorine, ozone, hydrogen peroxide) in a reacting vessel that contains an ultraviolet (UV) light source.	Potentially Applicable: May be effective for treatment of organics contaminants of concern.
		Chemical Dehalogenation	Chlorine would be removed from halogenated organic compounds by the addition of a reactant. Process would primarily be applicable to treatment of polychlorinated biphenyls.	Reject: Mainly used to remove PCBs from oil or soils.
		Neutralization	Acids or bases would be added to groundwater to adjust the pH.	Potentially Applicable: Not an effective primary treatment, but may be used as a pretreatment or polishing step.
	Biological	Aerobic Digestion	Degradation of organics using micro-organisms in an aerobic environment.	Potentially Applicable: May be effective for treatment of organics contaminants of concern.

TABLE 4-2
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR GROUNDWATER
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Treatment (continued)	Biological (continued)	Anaerobic Digestion	Degradation of organics using micro-organisms in a anerobic environment.	Potentially Applicable
		Powdered Activated Carbon Treatment (PACT)	Activated sludge treatment combined with powdered activated carbon, thus including both biological degradation and physical adsorption.	Potentially Applicable
	Thermal Destruction	Incineration	Incineration would use high-temperature oxidation under controlled conditions to degrade substances.	Reject: Not suitable for destruction of liquid wastes with dilute contaminant concentrations.
		Wet Air Oxidation	Organic and oxidizable inorganics in aqueous medium would be oxidized by addition of dissolved air under high pressures and temperatures under 650°F.	Reject: Not suitable for destruction of liquid wastes with dilute contaminant concentrations.
	Off-site	POTW	Extracted groundwater would be treated at a nearby POTW.	Reject: Contaminant concentrations identified in groundwater samples exceed current limitations for the City of Albany POTW.
		RCRA Treatment Facility	Extracted groundwater would be transported or piped to an off-site RCRA-approved facility for treatment.	Potentially Applicable: Depends on location of facility and volume of water.
	In-situ	Permeable Treatment Bed	A trench downgradient of the contaminant plume would be backfilled with a permeable medium, such as activated carbon, glauconitic green sands, or limestone, that reacts with or adsorbs contaminants entering trench.	Reject: Depth to water table and relatively low permeability of Residuum and Upper Ocala Limestone would be prohibitive.
		Bioremediation	A system of extraction and injection wells would be used to extract contaminated water. After treatment to acceptable levels, introduce nutrients into water, and reinject it into aquifer to enhance microbial degradation of contaminants at depth.	Potentially Applicable

TABLE 4-2
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR GROUNDWATER
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Treatment (continued)	In-situ (continued)	Aeration	A system of wells would be used to inject air into groundwater to remove volatile organics by a process similar to air stripping.	Potentially Applicable
		Neutralization	Dilute acids and bases would be injected into aquifer to adjust pH of groundwater.	Potentially Applicable: May not be effective for some organics.
		Oxidation	Oxidizing agent would be injected into aquifer to change the form of the contaminants through the loss of electrons.	Potentially Applicable
		Polymerization	A catalyst would be injected into the aquifer to convert a monomer of a contaminant to a large chemical multiple of itself, which has greater chemical, physical, and biological stability.	Reject: Not applicable for multiple contaminants at dilute concentrations.
Disposal	Discharge	Deep Well Injection	Treated or untreated groundwater would be discharged through a deep well system into a saline or otherwise unusable aquifer.	Potentially Applicable: Depends on volume of water to be disposed.
		Recharge Pond/Trench	Treated groundwater would be discharged into a trench that would allow water to percolate into an underlying aquifer. Trench might be located either on-site or off-site.	Potentially Applicable: Depends on volume of water to be disposed.
		Stream or Creek	Treated groundwater would be discharged to a nearby surface stream or creek either on-site or off-site.	Reject: Nearest stream or creek is located approximately 1 mile east of site.
		Off-site POTW	Treated groundwater would be discharged to a nearby publicly owned treatment works (POTW), through the exisiting on site sewer system.	Potentially Applicable: Discharged water would have to meet local POTW influent requirements.
		Reinjection Wells	Treated water would be discharged into reinjection wells screened in the same zone as the extraction wells.	Potentially Applicable

TABLE 4-2
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR GROUNDWATER
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Disposal (continued)	Reuse	Industrial	Extracted groundwater would be used for industrial applications such as cooling waters. The amount of treatment required would depend on the use of the water in industrial processes and effluent regulations.	Potentially Applicable
		Agricultural	Extracted and treated groundwater would be applied to land for irrigation.	Potentially Applicable

TABLE 4-3
EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER
BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action/ Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Status
No Action	None	No action taken.	No action taken.	No capital and O&M.	Retain
Institutional Controls Monitoring	Groundwater Monitoring	Would not remediate aquifer.	Easily implemented	Low capital and O&M.	Retain
Groundwater Use Restrictions	Deed Restrictions	Would prevent use of contaminated groundwater.	Easily implemented.	Low capital and O&M.	Retain
	Reasonable Use	Would prevent use of contaminated groundwater.	Would depend on cost of legal action and interpretation of court.	Low, includes legal costs.	Reject- deed restrictions would be more easily implemented
Containment Surface Controls	Drainage Controls	Would reduce the spread of contaminants.	Easily implemented	Low capital and O&M.	Retain
	Revegetation	May reduce infiltration of surface water.	Difficult to implement in courtyard area due to site conditions.	Low capital and O&M.	Reject.

TABLE 4-3 (Continued)
EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER
BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action/ Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Status
Capping	Clay	Effective in controlling infiltration of rainwater through contaminated soil if properly maintained. Susceptible to cracking although clay has some self-healing properties.	Difficult to implement in courtyard area due to site conditions.	Low capital and O&M.	Reject
	Asphalt	Effective in controlling infiltration of surface water if properly maintained. Susceptible to weathering and cracking.	Difficult to implement in courtyard area due to site conditions, but likely to be easier than other capping options.	Moderate capital; low O&M.	Retain
	Concrete	Effective in controlling infiltration of surface water if properly maintained. Susceptible to weathering and cracking.	Difficult to implement in courtyard area due to site conditions.	High capital; low O&M.	Reject

TABLE 4-3 (Continued)
EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER
BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action/ Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Status
Capping (continued)	Synthetic Membrane	Membrane would be susceptible to tearing and long term reliability is unknown.	Difficult to implement in courtyard due to site conditions.	Moderate capital and O&M.	Reject
	Multilayer	Effective in controlling infiltration of rainwater if properly maintained. Least susceptible to cracking of all capping technologies.	Difficult to implement in courtyard due to site conditions.	High capital and low O&M.	Reject
Removal					
Extraction	Extraction Wells	Effective means of removing contaminated groundwater.	Easily implemented. Some on-site wells already being used.	Costs for individual *extractions wells* relatively low. Actual costs will depend on required number of wells.	Retain

TABLE 4-3 (Continued)
EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER
BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action/ Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Status
Extraction (continued)	Subsurface Pipe Drains	Effective means of removing contaminated groundwater from beneath existing structures.	Difficult due to required depth.	High capital; moderate O&M.	Reject
Treatment Physical/ Chemical	Evaporative Ponds	May be effective for treatment of VOCs.	Would require large treatment area and disposal of residuals. May require air emission controls.	High capital and O&M.	Reject
	Spray Evaporation	May be effective for treatment of VOCs.	Would require large treatment area, disposal of residuals, may require air emission controls.	High capital and O&M.	Reject
	Precipitation	Not effective as primary treatment, but effective as pretreatment for removal of dissolved solids.	Easily implemented	Moderate capital and O&M.	Retain

TABLE 4-3 (Continued)
EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER
BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action/ Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Status
Physical/ Chemical (continued)	Flocculation/ Sedimentation	Not effective as primary treatment, but effective as a pretreatment step for removal of suspended solids.	Easily implemented	Moderate capital and O&M.	Retain
	Filtration	Not effective as primary treatment, but effective as a pretreatment or polishing step for removal of suspended solids.	Easily implemented	Low capital and low to moderate O&M.	Retain
	Air Stripping	Effective for removal of VOCs.	Commercially available, may require off-gas treatment. Treatability study has been performed.	Low capital and O&M plus cost of any required off-gas treatment.	Retain
	Granular Activated Carbon (GAC) Adsorption	Effective for removal of organics.	Easily implemented. Treatability study has been performed.	Moderate capital and O&M.	Retain

TABLE 4-3 (Continued)
EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER
BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action/ Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Status
Physical/ Chemical (continued)	Ion Exchange	Effective for removal of iron and manganese from groundwater. Exchangers require frequent regeneration.	Easily implemented. Requires treatability study.	High capital and moderate O&M.	Reject
	Reverse Osmosis	Effective for removal of dissolved solids from groundwater. Effectiveness may be reduced by the presence of suspended solids. Requires extensive pretreatment.	Easily implemented. Requires treatability study.	High capital and moderate O&M.	Reject

TABLE 4-3 (Continued)
EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER
BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action/ Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Status
Physical/ Chemical (continued)	Chemical Oxidation	Effective for removal of organic compounds. Oxidation reactions can be carried through to completion given adequate reaction time and oxidizer concentrations.	Requires extensive O&M. Over and under dosing of chemical oxidants may occur, resulting in unwanted halogenated organic by-product formation. Treatability study would be required.	Moderate capital; high O&M.	Reject
	Oxidation/ Ultraviolet Photolysis	Effective for removal of VOCs. May require higher flow rate than available.	Easily implemented. Treatability study would be required.	High capital and moderate O&M.	Reject
	Neutralization	Not effective as primary treatment but may be used as a pre-treatment or polishing step.	Easily implemented.	Low capital and O&M.	Reject - not anticipated to be required to meet discharge limits.

TABLE 4-3 (Continued)
EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER
BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action/ Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Status
Biological	Aerobic Digestion	Effective, proven and reliable for a wide range of organics. Concentrations of organics may be too dilute to be effective.	Treatment process can be upset by fluctuations in pH, temperature, feed compositions and concentration, and the presence of heavy metals. Extensive treatability studies would be required.	Moderate capital and O&M.	Reject
	Anaerobic Digestion	Effective, proven and reliable for a wide range of organics. Concentrations of organics may be too dilute to be effective.	Treatment process can be upset by fluctuations in pH, temperature, feed compositions and concentration, and the presence of heavy metals. Extensive treatability studies would be required.	Moderate capital and O&M.	Reject

TABLE 4-3 (Continued)
EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER
BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action/ Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Status
Biological (continued)	PACT	Effective, proven and reliable for a wide range of organics. Concentrations of organics may be too dilute to be effective.	Treatment process can be upset by fluctuations in pH, temperature, feed compositions and concentration, and the presence of heavy metals. Extensive treatability studies would be required.	Moderate capital and O&M.	Reject
Off-site	RCRA Treatment Facility	Effective for treatment and disposal of water.	RCRA facility is considerable distance from site.	High capital and transportation costs.	Reject
In-Situ	Aeration	Effective for organic compounds. Effectiveness limited by relatively low permeability of Residuum and Upper Ocala Limestone.	Implementable. Would require pilot testing.	Moderate capital and O&M.	Reject

TABLE 4-3 (Continued)
EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER
BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action/ Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Status
In-Situ (continued)	Bioremediation	Effective for organic compounds. Effectiveness limited by relatively low permeability of Residuum and Upper Ocala Limestone.	Implementable. Would require pilot testing.	Moderate capital and O&M.	Reject
	Neutralization	May be effective in conjunction with other in-situ process options.	Implementable. Would require pilot testing.	Moderate capital and O&M.	Reject-not required.No retained in-situ options.
	Oxidation	Effective for organic compounds only. Effectiveness limited by relatively low permeability of Residuum and Upper Ocala Limestone.	Implementable. Would require pilot testing.	Moderate capital and O&M.	Reject

TABLE 4-3 (Continued)
EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER
BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action/ Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Status
Disposal Discharge	Deep Well Injection	Effective method of groundwater disposal.	On-site injection not currently allowed under State of Georgia environmental regulations. No permitted facility located near site.	On-site: high capital and low O&M. Off-site: high transportation and disposal cost.	Reject
	Recharge Pond or Trench	Only moderately effective due to relatively low permeability of Residuum and Upper Ocala Limestone.	Difficult to implement due to regulatory process.	Moderate capital and O&M.	Reject
	Off-site POTW	Effective means of disposal.	Permitting required.	Low to moderate capital; moderate O&M.	Retain

TABLE 4-3 (Continued)
EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER
BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action/ Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Status
Discharge (continued)	Reinjection Wells	Only moderately effective due to relatively low permeability of Residuum and Upper Ocala Limestone.	Regulatory approval difficult to obtain. Relatively large number of wells may be required due to permeability conditions.	Moderate to high capital and O&M.	Reject
Reuse	Industrial	Effective means of disposal	Difficult to find industries willing to accept.	Transportation costs may be high	Reject
	Agricultural	Effective means of disposal	Regulatory approval is difficult to obtain. Difficult to find landowners willing to accept.	Transportation costs may be high	Reject

TABLE 4-4
SUMMARY OF RETAINED TECHNOLOGIES AND PROCESS OPTIONS FOR GROUNDWATER
FORMER FIRESTONE FACILITY
ALBANY, GEORGIA

General Response Action	Remedial Technology	Process Option
No Action	None	None
Institutional Controls	Monitoring	Groundwater
	Groundwater Use Restrictions	Deed restrictions
Containment	Surface Controls	Drainage controls
	Capping	Asphalt
Removal	Extraction	Extraction wells
Treatment	Physical/Chemical	Precipitation, flocculation/sedimentation, filtration, air stripping, granular activated carbon (GAC) adsorption
Disposal	Discharge	Off-site POTW

TABLE 4-5
SUMMARY OF POTENTIAL REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL
FORMER FIRESTONE FACILITY – ALBANY, GEORGIA

General Response Action	Remedial Technology	Process Option
No Action	None	None
Institutional Controls	Land Use	Deed restrictions
	Access Restrictions	Fencing
	Monitoring	Soil sampling, groundwater monitoring
Containment	Surface Controls	Soil stabilization, revegetation, drainage controls
	Capping	Clay, synthetic membrane, asphalt, concrete, multilayer
	Vertical Barriers	Slurry wall, grout curtain, sheet piling, vibrating beam, concrete diaphragm, rock grouting
	Horizontal Barriers	Grout injection, block displacement, liners
Removal	Excavation	Mechanical excavation
Treatment	Physical/Chemical	Soil washing, solvent extraction, stabilization/ solidification, glycolate dechlorination, low temperature thermal destruction
	Thermal	Rotary kiln, fluidized bed, pyrolysis, infrared
	Biological	Slurry-phase treatment, solid-phase treatment
	In-Situ	Stabilization/solidification, soil flushing, vitrification, vapor extraction
Disposal	Off-site	Incinerator, permitted landfill
	On-Site	Permitted landfill, placement of treated soils, reusable products

TABLE 4-6
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR SOIL
FORMER FIRESTONE FACILITY – ALBANY, GEORGIA

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
No Action	None	None	No actions would be taken.	Required for consideration by NCP.
Institutional Controls	Land Use	Deed Restrictions	All property with contaminated soil would have restrictions concerning land usage placed on the deeds.	Potentially Applicable
	Access Restrictions	Fencing	Contaminated areas would be surrounded with a fence to control access.	Potentially Applicable
	Monitoring	Soils Sampling	Periodic monitoring of surface and/or subsurface soils.	Reject: Would not effectively monitor contaminant migration.
		Groundwater Monitoring	Periodic monitoring of groundwater in areas of soil contamination.	Potentially Applicable
Containment	Surface Controls	Soil Stabilization	Chemical stabilizers would be sprayed on bare soils or mulched to coat, penetrate, and bind together the soil particles. Chemical stabilizers would include latex emulsions, plastic film, oil-in-water emulsions, and resin-in-water emulsions.	Reject: Long term reliability is unproven, may be subject to damage by ultra-violet light and water. Would lose effectiveness when disturbed by pedestrian and vehicular traffic.
		Revegetation	A vegetative cover would be re-established in areas that have been regraded or capped to decrease erosion and increase integrity of cap.	Potentially Applicable: May be used in conjunction with capping technologies.
		Drainage Controls	New drainage patterns would be established to prevent migration of contaminants.	Potentially Applicable: Used in conjunction with capping technology to control surface water migration through contaminated soil.
	Capping	Clay	Contaminated areas would be covered with compacted, clean clay.	Potentially Applicable: May decrease infiltration of precipitation through contaminated area.

TABLE 4-6
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR SOIL
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Containment (continued)	Capping (continued)	Synthetic Membrane	A synthetic membrane would be placed over area of contamination.	Potentially Applicable: May decrease infiltration of precipitation through contaminated area.
		Asphalt	Contaminated area would be covered with asphalt pavement.	Potentially Applicable: May decrease infiltration of precipitation through contaminated area.
		Concrete	Concrete slab would be installed over contaminated area.	Potentially Applicable: May decrease infiltration of precipitation through contaminated area.
		Multilayer	Contaminated area would be covered with a cap consisting of a three-layer system and conforming to RCRA regulations to reduce direct contact with and ingestion of contaminants.	Potentially Applicable: May decrease infiltration of precipitation through contaminated area. Layering would provide additional protection from infiltration.
	Vertical Barriers	Slurry Wall	A soil-cement or soil-bentonite slurry would be pumped into a trench as excavation proceeded and would be used to create a wall of low permeability.	Reject: Would not inhibit migration of contaminants due to primarily vertical flow.
		Grout Curtain	Grout would be injected or mixed into soil with auger-like blades to create a wall of low permeability.	Reject: Would not inhibit migration of contaminants due to primarily vertical flow.
		Sheet Piling	Sheet piling would be installed around wastes to prevent migration of contaminants.	Reject: Would not inhibit migration of contaminants due to primarily vertical flow.
		Vibrating Beam	A variation of a grout curtain in which a vibrating force would be used to advance a steel beam into the ground. Grout would be injected as the beam was withdrawn.	Reject: Would not inhibit migration of contaminants due to primarily vertical flow.

TABLE 4-6
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR SOIL
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Containment (continued)	Vertical Barriers	Concrete Diaphragm	Subsurface barrier of reinforced concrete panels, either cast-in-place or pre-cast.	Reject: Would not inhibit migration of contaminants due to primarily vertical flow.
		Rock Grouting	Grout would be injected into bedrock to seal fractures, solution cavities, and voids.	Reject: Would not inhibit migration of contaminants due to primarily vertical flow; depth to confining layer would be prohibitive.
	Horizontal Barriers	*Grout* Injection	*Grout* would be pressure-injected through drilled holes in a pattern to provide a low-permeable barrier beneath wastes.	Reject: Unproven technology; continuity of grout would be difficult to determine.
		Block Displacement	After contaminated areas were isolated by a vertical barrier, grout would be injected through holes bored through wastes. Continued grout pumping would cause upward displacement of the wastes.	Reject: Unproven technology; continuity of grout would be difficult to determine.
		Liners	Clay, synthetic, or multi-layer.	Reject: Contaminated soil would require excavation prior to placing liner.
Removal	Excavation	Mechanical Excavation	Soils would be removed by common excavation equipment and disposed or treated.	Potentially Applicable: Effective means of removing contaminated soils.
Treatment	Physical/ Chemical	Soil Washing	Process similar to solvent extraction except water and appropriate chemical additives or surfactants would be used to extract target compounds.	Potentially Applicable: Has been demonstrated to remove and concentrate both organic and inorganic compounds. Low soil permeability may make technology infeasible.
		Solvent Extraction	Chemical extraction process would be used to separate extractable organic compounds from contaminated soil. Solids would be separated from the spent chemical extraction solvent. Spent solvent and concentrated organic residuals would require further treatment or disposal.	Potentially Applicable: Low soil permeability may make technology infeasible.

TABLE 4-6
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR SOIL
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Treatment (continued)	Physical/ Chemical (continued)	Stabilization/ Solidification	Stabilization refers to the immobilization of chemical constituents within a solid matrix (soils, sediments or sludges) such that constituents will not leach from the stabilized soils. Solidification refers to the process by which solids are transferred into a solid form capable of supporting loads.	Potentially Applicable: Can be used to treat wastes containing heavy metals and low mobility organics.
		Glycolate Dechlorination	Dechlorination of soils using sodium or potassium polyethylene glycolate reagents combined with heat in a reactor vessel. Used to dechlorinate PCBs, dioxins, chlorophenols, and chlorobenzenes.	Potentially Applicable: May be used to remove PCBs from soil.
		Low Temperature Thermal Stripping	Contaminated soils would be heated in an indirectly-fired rotary dryer to volatilize the organics. The vapors would be carried to a gas handling system with an inert gas and then cooled to condense the organics.	Reject: Not applicable to PCBs.
	Thermal Incineration	Rotary Kiln	Solid waste would be fed into a kiln that would rotate to mix the waste with combustion air as the wastes pass through.	Potentially Applicable: Would be effective for destroying organics but not metals.
		Fluidized Bed	Soils would be injected above a preheated granular bed that would be fluidized by bubbling air through a distributor plate up into the bed.	Potentially Applicable: Would be effective for destroying organics but not metals.
		Circulating Bed	Process has been adapted from fluidized bed incineration. Circulating bed would operated with higher velocities than conventional fluidized bed. Fluidized material would be recirculated through the feed section.	Potentially Applicable: Would be effective for destroying organics but not metals.

TABLE 4-6
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR SOIL
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Treatment (continued)	Thermal Incineration (continued)	Pyrolysis	Chemical decomposition of organics by heating waste in the absence of oxygen to reduce toxic organic constituents to elemental gas and water.	Potentially Applicable: Would be effective for destroying organics but not metals.
		Infrared Thermal Treatment	Thermal units use silicon carbide elements to generate thermal radiation. Material to be treated pass through the unit on a belt and are exposed to the radiation. Off-gases pass into a secondary chamber for further infrared irradiation and increased retention time.	Potentially Applicable: Would be effective for destroying organics but not metals.
	Biological	Slurry-Phase Treatment	Treatment of an aqueous slurry (created by mixing soil with water) in a bioreactor vessel.	Potentially Applicable
		Solid-Phase Treatment	Treatment of soils in an above grade system by regular tilling and by the addition of oxygen, nutrients and water.	Potentially Applicable
		Composting	Storage of highly degradable and structurally firm material (e.g., wood chips) with less than 10 percent of biodegradable waste. Three basic types of composting consist of: open windrow systems, static windrow systems, and in-vessel (reactor) systems.	Potentially Applicable
	In-Situ	Stabilization/ Solidification	Pozzolanic ingredients and water would be blended with soil in place. The treated soils would form a monolithic, stabilized mass that would remain isolated from the environment.	Potentially Applicable: Certain chemicals may inhibit stabilization process.

TABLE 4-6
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR SOIL
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Treatment (continued)	In-Situ (continued)	Soil Flushing	Soil would be flushed with water or other detergent solutions to mobilize contaminants. The impregnated water would be intercepted, collected, and pumped to the surface for separation of contaminants.	Potentially Applicable: Low soil permeability may make technology infeasible.
		Vitrification	Electrodes are used to create a current in the contaminated soil to melt it. Soil would have to contain significant levels of silicates. Inorganics and some organics would be trapped in the melt, which could form obsidian or very strong glass as it cooled.	Potentially Applicable: Applicable treatment of organics and inorganics.
		Vapor Extraction	Probes or wells would be installed into the vadose (unsaturated) zone. A vacuum would be applied to the wells in order to extract volatile organic compounds from the soil pores. The vacuum would continually draw contaminated air from the soil pores while it would draw fresh air from the surface into the soil. The extracted air would be treated before being dispersed into the atmosphere.	Reject: Not applicable to treatment of PCBs.
		Bioremediation	Controlled management of microbial population and their degradation products in place. Aerobic, anaerobic or co-metabolic processes may be utilized.	Potentially Applicable: Applicable to treatment of organics. Not applicable for metals. Certain metals might inhibit the activity of micro-organisms.
Disposal	Off-site	Incinerator	Soils would be transported to commercially licensed hazardous waste incineration facility for incineration.	Potentially Applicable

TABLE 4-6
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR SOIL
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action	Remedial Technology	Process Option	Description	Screening Comments
Disposal (continued)	Off-site	Permitted Landfill	Soils would be transported and placed in an appropriately permitted commercial landfill.	Potentially Applicable: Effective means of containment of wastes.
	On-site	Permitted Landfill	Soils would be excavated and placed in a permitted landfill located on-site.	Potentially Applicable: Effective means of containment of wastes.
		Placement of Treated Soil	Treated soil is placed back on-site.	Potentially Applicable: Effective means of containment of wastes.
		Reusable Products	Soils would be processed, and useful waste products would be reclaimed.	Reject: No reusable wastes would be generated.

TABLE 4-7
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR SOIL
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action / Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Status
No Action	None	No action taken.	Easily implemented because no action would be required.	No capital and O&M costs.	Retain, as required by the NCP.
Institutional Controls					
Monitoring	Groundwater Monitoring	Effective for evaluating migration of contamination to the groundwater.	Easily implemented. Requires installation of well(s).	Low capital and O&M.	Retain
Land Use	Deed restrictions	Provides limited protection to receptors.	Legal Requirements. May impact current and future facility operations and expansions.	Low capital and O&M costs.	Retain
Access	Fencing	Provides limited protection to receptors.	Easily implemented. Legal Requirements.	Low capital and O&M costs.	Retain

TABLE 4-7 (Continued)
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR SOIL
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action / Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Status
Containment					
Surface Controls	Revegetation	Effective for reducing soil erosion. May reduce infiltration of surface water.	Difficult to implement in courtyard area.	Low capital and O&M.	Reject
	Drainage Controls	Effective for reducing surface water infiltration and ponding in capped area. Would minimize spread of contaminants.	Easily Implemented	Low capital and O&M.	Retain
Capping	Clay	Effective in controlling infiltration of rainwater through contaminated soil if properly maintained. Susceptible to cracking although clay has some self healing properties.	Difficult to implement in courtyard area due to site conditions.	Low capital and O&M.	Reject

TABLE 4-7 (Continued)
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR SOIL
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action / Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Status
Capping (continued)	Synthetic Membrane	Membrane would be susceptible to tearing, and long-term reliability would be uncertain.	Difficult to implement in courtyard area.	Moderate capital and O&M.	Reject
	Asphalt	Effective in controlling infiltration of rainwater through contaminated soil if properly maintained. Susceptible to weathering and cracking.	Difficult to implement in courtyard area, but likely to be easier to implement than other capping options.	Moderate capital; low O&M.	Retain as representative capping technology.
	Concrete	Effective in controlling infiltration of rainwater through contaminated soil if properly maintained. Susceptible to weathering and cracking.	Difficult to implement in courtyard area due to site conditions.	High capital; low O&M.	Reject - Similar to asphalt in effectiveness and implementability, but at a higher cost.

TABLE 4-7 (Continued)
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR SOIL
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action / Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Status
Capping (continued)	Multilayer	Effective in controlling infiltration of rainwater through contaminated soil if properly maintained. Least susceptible to cracking of all capping technologies.	Difficult to implement in courtyard area due to site conditions.	High capital; low O&M.	Reject - cost prohibitive due to low volume of soil requiring remedial action.
Removal Excavation	Mechanical Excavation	Effective	Easily implemented	Low capital; no O&M.	Retain
Treatment Physical/ Chemical	Solvent Extraction	Effective, proven option for organic compounds. Effectiveness may be limited by low soil permeability.	Difficult to implement due to small volume of soil to be treated. Treatability testing and treatment or disposal of by-products required.	High capital; no O&M.	Retain as representative on-site treatment.

TABLE 4-7 (Continued)
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR SOIL
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action / Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Status
Physical/ Chemical (continued)	Stabilization/ Solidification	Effective for low mobility organics. Less effective for volatile organics.	Difficult to implement due to low volume of soil to be treated. Treatability testing, performance evaluation, and long-term management required for PCBs.	High capital; low to moderate O&M.	Reject - Not required for off-site landfilling. TSCA chemical waste landfill requirements would have to be addressed for on-site disposal.
	Glycolate Dechlorination	Effective for treatment of PCBs, dioxins, chlorophenols, and chlorobenzenes.	May require several treatment cycles to achieve desired levels. Treatability testing would be required.	High capital; no O&M.	Reject - cost for treatment would be prohibitive due to low volume of soil to be remediated.
Thermal Incineration	Rotary Kiln	Effective, proven, and reliable process option for removal of organics.	Regulatory approval may be very difficult.	High capital; no O&M.	Reject - cost for treatment would be prohibitive due to low volume of soil to be remediated.

TABLE 4-7 (Continued)
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR SOIL
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action / Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Status
Thermal Incineration *(continued)*	Fluidized Bed	Effective and reliable method for organics removal. Less effective than rotary kiln.	Regulatory approval and public acceptance very difficult. Pretreatment (grinding and size reduction) may be required.	High capital; no O&M.	Reject
	Circulating Bed	Effective and reliable method for organics removal. Less effective than rotary kiln.	Regulatory approval and public acceptance very difficult. Pretreatment (grinding and size reduction) may be required.	High capital; no O&M.	Reject
	Pyrolysis	Effective for destruction of organics. Less effective than rotary kiln.	Regulatory approval may be very difficult.	High capital; no O&M.	Reject
	Infrared Thermal Treatment	Effective for destruction of organics. Effectiveness similar to rotary kiln.	Regulatory approval may be very difficult. Technology relatively new.	High capital; no O&M.	Reject

TABLE 4-7 (Continued)
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR SOIL
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action / Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Status
Biological	Slurry-Phase Treatment	Effective for wide range of organics.	A slurry has to be made from soil. Extensive treatability testing would be required.	High cost of treatability testing for the limited volume of contaminated soil.	Reject
	Solid-Phase Treatment	Has been applied to a wide range of organics.	Extensive treatability testing would be required.	High cost of treatability testing for the limited volume of contaminated soil.	Reject
	Composting	Experimental process for decomposition of organics in soil. Kinetics likely to be slow for PCBs.	Extensive treatability testing would be required.	High cost of treatability testing for the limited volume of contaminated soil.	Reject

TABLE 4-7 (Continued)
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR SOIL
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action / Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Status
In-Situ	Stabilization/ Solidification	Effective for low mobility organics. Less effective for volatile organics. Long-term effectiveness is uncertain.	Implementation difficult due to small volume of soil to be treated and access restrictions. Performance evaluation and long-term management required for PCBs.	Moderate to high capital; low to moderate O&M.	Reject
	Soil Flushing	Effective, proven option for organics. Effectiveness may be limited by low soil permeability. Less effective on complex waste mixtures.	Easily implemented. Treatability testing required. Treatment or disposal of by-products required.	High cost of treatability testing for the limited volume of contaminated soil.	Reject
	Vitrification	Effective for treatment of organics and inorganics.	Treatability testing would be required.	High capital; low O&M.	Reject

TABLE 4-7 (Continued)
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR SOIL
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action / Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Status
In-Situ (continued)	Bioremediation	Effective on selected organics. Effectiveness can be upset by fluctuations in pH, temperature, feed composition, and concentration, and the presence of heavy metals, pesticides, and/or highly chlorinated organics.	Extensive treatability testing required.	High cost of treatability testing for the limited volume of contaminated soil.	Reject
<u>Disposal</u>					
Off-Site	Incinerator	Effective and reliable method for waste destruction. Contamination is removed from the site.	Easily implemented	High capital; no O&M.	Retain - Would be required for off-site disposal of solvent used for solvent extraction process.

TABLE 4-7 (Continued)
INITIAL SCREENING OF TECHNOLOGIES AND
PROCESS OPTIONS FOR SOIL
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action / Remedial Technology	Process Options	Effectiveness	Implementability	Cost	Status
Off-Site (continued)	Permitted Landfill	Effectively removes contamination from the site.	Easily implemented	Moderate capital; no O&M.	Retain - current regulations allow for disposal of materials with concentrations up to 500 mg/kg PCBs.
On-Site	Permitted Landfill	Effective means of containing contaminants. Volume or toxicity of contaminants not reduced or eliminated.	Difficult to implement. Requires construction and permitting. Land disposal restrictions and state/community acceptance could interfere.	Very high capital, moderate O&M.	Reject
*	Placement of Treated Soil	Effective means of disposal.	Easily implemented. Treated soil must meet applicable land disposal restrictions.	Moderate capital; no O&M.	Retain

TABLE 4-8
SUMMARY OF RETAINED REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

General Response Action	Remedial Technology	Process Option
No Action	None	None
Institutional Controls	Land Use	Deed restrictions
	Access	Fencing
	Monitoring	Groundwater monitoring
Containment	Surface Controls	Drainage controls
	Capping	Asphalt
Treatment	Physical/Chemical	Solvent extraction
Removal	Excavation	Mechanical excavation
Disposal	Off-site	Permitted landfill, incineration
	On-site	Placement of treated soil

5.0 DEVELOPMENT AND SCREENING OF ALTERNATIVES

The goal in developing the remedial alternatives is to provide a range of cleanup options together with sufficient information to adequately compare alternatives against one another. For each affected medium (groundwater and soil), retained technologies and processes from Section 4.0 were combined to form a range of remedial alternatives for the initial screening.

This section describes the development of the preliminary remedial alternatives for both groundwater and soil contamination. It also describes the initial screening of these alternatives based on effectiveness, implementability, and cost to identify those groundwater and soil alternatives that will be further evaluated in Section 6.0 and Section 7.0, respectively.

The alternatives for groundwater and soil have been developed separately. One alternative for each medium should be implemented at the site to provide the most adequate degree of protection to human health and the environment. Potential combinations of groundwater and soil alternatives are evaluated in Section 8.0

5.1 ASSEMBLED GROUNDWATER ALTERNATIVES

Remedial alternatives that prevent or minimize human exposure to all groundwater with contaminant concentrations that exceed the remediation goals were assembled. The assembled alternatives also provide protection of the environment against exceeding these goals in potentially usable groundwater located outside of the current manufacturing area. Four types of remedial alternatives have been developed: no action, institutional controls, containment, and active restoration. Remedial alternatives for groundwater have been developed for all four types of responses.

The no action and institutional controls responses would rely on the groundwater's natural ability to lower contaminant levels through physical, chemical and biological processes. A no action response would rely entirely on these natural processes, with no external assistance. The institutional controls response action would assume responsibility for maintaining effective and reliable institutional controls to prevent use of the groundwater and continue an on-going monitoring program to provide information on the changes in contaminant concentrations and locations.

Containment is intended to control the dispersion of contaminants by inhibiting the movement of groundwater at the site. This alternative would not actively remediate the contaminants in the groundwater and would rely on the groundwater's natural ability to lower contaminant concentrations.

Active restoration refers to the use of an extraction and treatment or in-situ treatment system to remove contaminants from the groundwater. Extraction and treatment would be followed by discharge either on or off site. Use of an active restoration alternative would generally reduce groundwater contaminants more rapidly than passive remediation alternatives.

The technology and process options for groundwater remediation that were retained after the screening and evaluation processes are listed in Table 4-4. These process options represent a pool from which remedial alternatives were developed. Assembled alternatives for groundwater are listed in Table 5-1. Table 5-2 provides a summary of the evaluation of the groundwater alternatives. A general description of these alternatives is presented below. The descriptions include the components of each alternative, general design and construction considerations, and effectiveness, implementability, and cost evaluations.

5.1.1 Groundwater Alternative A: No Action

For groundwater Alternative A, no remedial actions would be implemented. This alternative is required by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and serves as a baseline against which the other alternatives are compared.

5.1.1.2 Effectiveness

The no action alternative does not provide any additional protection to human health or the environment. The current and future public health and environmental risks would remain at the levels identified in the baseline risk assessment.

5.1.1.3 Implementability

Groundwater Alternative A can be easily implemented. The no remedial action would rely on the natural attenuation to reduce the volume, toxicity, and mobility of the contaminants.

5.1.1.4 Cost

Groundwater Alternative A would not require any capital or O&M expenditures.

5.1.2 Groundwater Alternative B: Institutional Controls

Alternative B consists of institutional controls such as deed restrictions in combination with groundwater monitoring. This alternative is intended to reduce any potential health risks associated with the contaminated groundwater. Deed restrictions would be placed on the manufacturing area to prohibit the installation of new water supply wells. [The potential for cross-contaminating of the lower groundwater zones and increasing the hydraulic gradient are prevented by prohibiting the installation of new wells.] This alternative provides for the natural attenuation of contaminants to restore groundwater quality. Groundwater sampling and analysis for identified contaminants of concern would be performed periodically in the courtyard area and at the boundary of the current manufacturing area as defined in the baseline risk assessment. This monitoring would be used to identify the effectiveness of natural attenuation as a remedial option and to assess potential contaminant migration.

5.1.2.1 Effectiveness

This alternative would be protective of human health because it restricts the potential exposure to the groundwater. Monitoring would continue to evaluate the attenuation of the contaminants. Existing site conditions indicate that adequate protection of the environment will be provided through natural attenuation. The toxicity, mobility, and volume of contaminants would also be reduced through natural attenuation. The effectiveness of Groundwater Alternative B would depend on the degree of enforcement of the deed restrictions. No unacceptable short-term health risks to workers are expected to occur because the implementation of this alternative requires limited activities. Groundwater monitoring would be an effective method of monitoring changes in groundwater contaminant concentrations and would prevent the migration of contaminants to or beyond the manufacturing area.

5.1.2.2 Implementability

Groundwater Alternative B would be easily implemented. Restrictions placed on groundwater would be obtained through the local courts, and enforcement of these restrictions would be implementable. The groundwater monitoring would utilize some existing monitoring wells. Any additional on-site monitoring wells required for this alternative would be installed using conventional techniques. Services for monitoring well installation are readily available.

5.1.2.3 Cost

Groundwater Alternative B would require low capital expenditure for implementation. The capital costs would include monitoring well installation and establishing the deed restrictions and installation of groundwater monitoring wells. The capital cost of Alternative B would be lower than for Groundwater Alternatives C and D. Low O&M costs would be incurred primarily through groundwater sampling and analysis.

5.1.3 Groundwater Alternative C: Institutional Controls and Containment

Groundwater Alternative C consists of institutional controls through deed restrictions and groundwater monitoring and containment. Containment would involve the installation of an asphalt cap over portions of the courtyard area and any necessary drainage controls. The cap would reduce infiltration of surface water and subsequent migration of the contaminants. Drainage controls would provide additional protection from infiltration and damage to the cap. Deed restrictions and groundwater monitoring would be implemented as described for Alternative B.

5.1.3.1 Effectiveness

This alternative would be protective of human health because it restricts the potential for exposure to the groundwater and would monitor the potential for migration of contaminants. Additional protection of the environment would be provided by retarding the vertical migration of contaminants. The long-term effectiveness of the cap is dependent on the quality of the cap construction and maintenance. The cap would be subject to heavy traffic and would have to be designed to maintain the site activity. Mobility of the contaminants would be reduced. However, the cap is likely to inhibit the natural attenuation processes, thereby increasing the length of time required for reduction in toxicity and volume through natural attenuation. Groundwater monitoring would be an effective method of monitoring the natural attenuation of the contaminants and would provide a mechanism for preventing the potential migration of contaminants to or beyond the boundary of the manufacturing area.

5.1.3.2 Implementability

Materials and services required for cap installation are readily available. As described for Alternative B, deed restrictions and groundwater monitoring should be easily implemented. Additional groundwater monitoring wells are anticipated to be required for this alternative.

5.1.3.3 Cost

The cost of implementing Alternative C would be moderate and would be associated with the installation of the cap and monitoring wells, and establishing the deed restrictions. Capital costs would be higher than for Alternative B, but lower than for the treatment alternative. Moderate O&M costs would be incurred by the necessary maintenance of the cap and the cost of groundwater sampling and analysis.

5.1.4 Groundwater Alternative D: Institutional Controls, Pumping Wells, On-site Treatment, and Discharge to POTW

Groundwater Alternative D includes deed restrictions, groundwater monitoring, extraction of contaminated groundwater using pumping wells, and subsequent on-site treatment using air stripping. Extraction would be accomplished by placing pumps in the courtyard area monitoring wells in which contaminants have been detected above the remediation goals. The extracted groundwater would be pumped through any necessary solids removal system to remove suspended and/or dissolved solids and through the air stripping system to remove VOCs. The treated groundwater would be discharged through the existing sewer system to the local POTW. Regular monitoring of the groundwater would be utilized during extraction and treatment to monitor the changes in contaminant concentrations in the pumping wells and in additional monitoring wells located at the boundary of the manufacturing area.

The air emissions from an air stripping system are anticipated to be within the range of values considered acceptable by the potential ARARs. The Georgia Department of Natural Resources (DNR) has a policy on treatment of contaminated groundwater from RCRA/CERCLA sites which requires best available control technology (BACT) for air emissions. The proposed air stripper design considers the Georgia DNR policy by using a vapor-phase GAC.

Deed restrictions and groundwater monitoring would be implemented as described for Alternative B.

5.1.4.1 Effectiveness

Alternative D is effective in protecting human health, remediating the groundwater, and reducing further migration of the contamination. The pumping system would reduce the mobility and volume of the contaminants, while treatment would reduce the toxicity and further reduce the volume. Filtration and flocculation/sedimentation would be effective in removing suspended solids from the water to increase the efficiency of the other components of the treatment system. Precipitation could be used to remove dissolved solids, such as iron or calcium.

The treatability study performed for the air stripping indicates that air stripping would effectively remove the VOCs from the groundwater at the site (WCC, 1992c). No adverse health or environmental effects would be associated with these technologies.

5.1.4.2 Implementability

Groundwater Alternative D would be readily implemented. The design and installation of the pumping system would be achieved using conventional methods. Two pumping wells (PTW-1 and MW-1-3) are currently in use at the site.

The treatment system is readily implementable. All treatment technologies are proven, reliable methods and commercially available for treating contaminated groundwater. The systems would be automated, with some maintenance requirements. Wastes generated from the solids removal or spent GAC would be disposed in an appropriately permitted landfill, incinerated, or regenerated for further use.

A sewer system is already in place and in use at the site. Discharge of treated water to the POTW would require a permit from the local POTW.

The installation of monitoring wells at the perimeter of the manufacturing area would be easily accomplished using conventional techniques. The services required for the installation are readily available.

5.1.4.3 Cost

The capital required to implement Alternative D would be moderate to high in comparison to the other alternatives. These costs would be incurred in the installation of the pumps, collection system, treatment system, and monitoring wells. The cost of obtaining the required discharge permit and deed restrictions also would be included in the alternative. The O&M costs would include the upkeep of the extraction and treatment system, disposal of treatment residuals, such as spent filters and GAC, and sampling and analysis of groundwater and treated effluent. The capital and O&M costs for Alternative D would be higher than for the other alternatives.

5.2 SUMMARY OF PRELIMINARY ALTERNATIVES SCREENING FOR GROUNDWATER

The NCP requires that the preliminary alternatives be subjected to an initial screening which eliminates those alternatives that have adverse impacts on public health and the environment; are not applicable to the contaminants and the media at the site; and are not orders of magnitude higher in cost to implement than other alternatives that provide the same level of protection. The groundwater alternatives that pass the initial screening will be further developed and evaluated in detail in Section 6.0. The groundwater screening results are presented in Section 5.2.1. Table 5-2 summarizes the preliminary screening of the groundwater alternatives based on effectiveness, implementability, and cost. Table 5-2 also indicates whether the alternative was retained for further development in Section 6.0.

5.2.1 Groundwater Alternatives

Four alternatives were developed for remediation of the contaminated groundwater at the site. Groundwater Alternatives A and B propose that no action and institutional controls be taken to remediate the contaminated groundwater at the site. Alternative C proposes to install a cap over the courtyard area for containment. Alternative A does not provide an effective method to evaluate the migration of the contaminated groundwater. Alternatives B, C, and D would be more protective of human health by restricting groundwater use and providing a mechanism to assess the potential migration of contaminants. The toxicity, volume and mobility of the contaminants would be reduced through natural attenuation in Alternatives A or B. Alternative B provides a mechanism for monitoring the groundwater conditions. Although the groundwater would also be passively remediated in Alternative C, additional protection of the environment would be provided by retarding infiltration and downward migration of surface water at the site. Alternative D, which includes active extraction of the groundwater, would provide reduction of the toxicity, mobility, and volume of the contaminants in the groundwater at an accelerated pace.

The short term risks to the public and environment are expected to be minimal for all the alternatives with the exception of Alternative A, which would involve no risk. A potential exists for workers to be exposed to contaminants during monitoring and remedial actions, but these risks would be reduced by wearing appropriate personal protective equipment and compliance with OSHA regulations.

The equipment and services required to implement any of the alternatives would be readily available. No capital or O&M costs would be incurred in the implementation of Alternative A. Capital and O&M costs are expected to be relatively low for Alternative B and somewhat higher for Alternative C. The capital and O&M costs associated with Alternatives D are expected to be the highest of the four alternatives.

As indicated in Table 5-2, all four groundwater alternatives were retained for further detailed evaluation in Section 6.0. Alternative A, the no action alternative, was retained as a baseline for evaluation against other retained alternatives.

5.3 ASSEMBLED SOIL ALTERNATIVES

Remedial alternatives for soil were developed to treat the principal threats posed by the site but vary the degree of treatment employed and the quantities and characteristics of the treatment residuals and untreated wastes that must be managed.

The no action response would provide minimal measures to protect human health and the environment. Imposing institutional or access controls could reduce the potential exposure to PCBs. Neither alternative would provide any active treatment.

Containment is intended to prevent potential exposure to contaminated soil and reduce the mobility of contaminants to protect human health and the environment. Typically, no treatment would be included in the containment alternative. A capping technology is considered as containment. This alternative would be somewhat more protective of human health and the environment than the no action or institutional control alternatives.

Treatment is intended to reduce or eliminate the need for long term management at the site. Use of a treatment alternative would reduce or eliminate PCBs. This type of alternative would be more protective of human health and the environment than the other alternative types.

The technology and process options for soil remediation that were retained after the screening and evaluation process are listed in Table 4-8. These process options represent a pool from which remedial alternatives were developed. Assembled alternatives for soil are listed in Table 5-3. A general description of these alternatives is presented below. The descriptions include the components of each alternative, general design and construction considerations, and effectiveness, implementability, and cost evaluations.

5.3.1 Soil Alternative A: No Action

In Soil Alternative A, no remedial actions would be implemented and the site would remain in its current condition. This alternative is required by the NCP and serves as a baseline against which other alternatives are compared.

5.3.1.2 Effectiveness

The no action alternative does not provide any additional protection to human health or the environment. The current and future environmental and public health risks would remain at the levels identified in the baseline risk assessment.

5.3.1.3 Implementability

Soil Alternative A would be easily implemented.

5.3.1.4 Cost

Soil Alternative A would not require any capital or O&M expenditures.

5.3.2 Soil Alternative B: Institutional Controls

Alternative B would consist of institutional controls to reduce potential health risks associated with PCBs at the site. Institutional controls would consist of placing deed restrictions on the site for present and future uses. In conjunction with deed restrictions, a security fence would be constructed around the contaminated area to reduce the possibility of ingestion or direct contact with the PCBs. A monitoring well would be installed and sampled to evaluate possible migration of PCBs to the groundwater.

5.3.2.1 Effectiveness

This alternative would effectively protect human health by reducing the potential for direct contact with or ingestion of PCBs. Protection of the environment would not change. Sampling and analysis of groundwater would be an effective method of monitoring migration of PCBs. No treatment would take place to actively reduce the toxicity, mobility and volume of contamination. Effectiveness in protecting human health would depend on the enforcement of the deed restrictions.

5.3.2.2 Implementability

Soil Alternative B may be somewhat difficult to implement. Deed restrictions would be coordinated through local courts and might be difficult to obtain due to the current facility operations and expansions. Materials and crews for the construction of the fence and monitoring well would be readily available.

5.3.2.3 Cost

The overall cost to implement Soil Alternative B are expected to be moderate to high. The capital costs associated with this alternative include installation of a security fence around the area of contamination, installation of a monitoring well, and development of an appropriate deed restriction. O&M costs would be relatively high in comparison to other soil alternatives and would be associated with maintenance of the security fence and long term monitoring of groundwater.

5.3.3 Soil Alternative C: Institutional Controls and Containment

Alternative C would consist of institutional controls and containment to reduce potential health risks associated with the PCBs in the site soil. Institutional controls would consist of placing deed restrictions on the site for present and future uses, construction of a security fence around the contaminated soil area to reduce the possibility of ingestion of or direct contact with the PCBs, and installation and sampling of a monitoring well to evaluate possible migration of PCBs into the groundwater. Containment would include the construction of an asphalt cap over the contaminated area. Drainage controls would be incorporated into the design of the cap.

5.3.3.1 Effectiveness

This alternative would be effective in protecting human health by reducing the potential for direct contact and ingestion of contaminants. Although the contaminants would remain on site, the cap would provide some protection for the environment by reducing the potential for leaching into the groundwater. Sampling and analysis of groundwater would be an effective method of monitoring potential migration of the PCBs. No treatment would take place to actively reduce the toxicity and volume of contamination. The cap would reduce mobility because it would retard surface water infiltration and migration through contaminated soil. Effectiveness in protecting human health would depend on the enforcement of the deed restrictions and the quality of cap design and construction.

5.3.3.2 Implementability

Soil Alternative C may be somewhat difficult to implement due to the current facility operations and expansions in this area. Construction materials and labor for the fence, cap, and monitoring well would be readily available.

5.3.3.3 Cost

Cost to implement Soil Alternative C is likely to be relatively high. The capital costs associated with this alternative include installation of a security fence, monitoring well, and asphalt cap, and development of an appropriate deed restriction. O&M costs would be relatively high in comparison to other soil alternatives and would be associated with maintenance of the security fence, asphalt cap, and long-term monitoring of groundwater.

5.3.4 Soil Alternative D: Excavation and Off-Site Disposal

Soil Alternative D would include excavation of the contaminated soil and transportation to an off-site permitted landfill. The contaminated soil would be excavated using conventional construction equipment and loaded into lined, covered roll-off containers or dump trucks for transportation to a TSCA-permitted, off-site landfill. The excavation would be backfilled with clean fill material.

5.3.4.1 Effectiveness

This alternative would be effective in protecting human health by eliminating the potential for ingestion of or direct contact with contaminants. Appropriate safety precautions would be maintained to reduce the potential for adverse risks to workers during excavation of soil. Soil Alternative D would remove the contaminated soil from the site, thereby eliminating the risks posed by the PCBs to human health and the environment.

5.3.4.2 Implementability

Soil Alternative D would be easily implemented. The excavation would be performed using conventional methods and should not present any special difficulties. The contaminated soil would be transported to a TSCA-permitted off-site landfill by an appropriately licensed transporter.

5.3.4.3 Cost

The overall cost to implement Soil Alternative D would be relatively low. The capital costs associated with this alternative include excavation, transportation, landfill charges and restoration of the excavated area. There are no O&M costs associated with this alternative.

5.3.5 Soil Alternative E: Excavation, Solvent Extraction, and On/Off-Site Disposal

Soil Alternative E involves excavation, treatment, and on-site disposal of the contaminated soil. Excavation would be accomplished using conventional earth moving equipment. A solvent extraction process would be used to treat the contaminated soil on site. Solvent extraction involves removing PCBs from the excavated soil and concentrating them in a residual side-stream. A multi-stage extraction may be required to reduce PCB concentrations in the soil to less than 2 mg/kg so that the soil is acceptable for on-site disposal with no long term management controls. Recovered contaminants would be containerized and shipped off-site for disposal at an approved facility.

5.3.5.1 Effectiveness

The effectiveness of the solvent extraction process in reducing PCB concentrations in the site soil is unknown at this time. The U.S. EPA (1990b) has stated that treatability tests run to date have indicated that there is probably a limit to the percentage reduction (on the order of 99.5%) achievable with this process. A multi-stage process can increase the reduction obtained and is likely to be required in order to obtain an acceptable contaminant concentration level for on-site disposal. This alternative would be effective in protecting human health by eliminating the potential for ingestion of or direct contact with contaminants. Appropriate safety precautions would be maintained to reduce the potential for adverse risks to workers during excavation of soil and the solvent extraction process.

5.3.5.2 Implementability

Required materials, services, and equipment would be difficult to obtain due to the low volume of soil to be treated. Treatability testing and permitting would be required for the on-site treatment. Extracted contaminants would require disposal at an approved facility.

5.3.5.3 Cost

Costs to implement Soil Alternative E are likely to be relatively high. The capital costs associated with this alternative are anticipated to include treatability testing, excavation, solvent extraction, off-site disposal of extracted contaminants, on-site disposal of treated soil, and restoration of the excavated area. Mobilization/demobilization costs would be disproportionately high considering the small volume of soil to be treated. There are no O&M costs associated with this alternative, as no long term management would be required once the PCB concentrations are reduced to levels of less than 2 mg/kg.

5.4 SUMMARY OF PRELIMINARY ALTERNATIVE SCREENING FOR SOIL

The NCP requires that the preliminary alternatives be subjected to an initial screening to eliminate those alternatives that have adverse impacts on public health and the environment, are not applicable to the contaminants and the media at the site, or are much more expensive to implement than other alternatives that provide essentially the same level of protection. The soil alternatives that pass the initial screening will be further developed and evaluated in detail in Section 7.0. Descriptions of the soil remedial alternatives were provided in Section 5.3. In addition to the descriptions of the technologies and process options that compose the alternatives, an evaluation of each alternative's effectiveness in protecting human health and the environment, the feasibility of implementing the alternative and the relative costs are presented. The soil screening results are presented in Section 5.4.1. Table 5-4 summarizes the preliminary screening of the soil alternatives based on effectiveness, implementability, and cost. Table 5-4 also indicates whether the alternative was retained for further development in Section 7.0.

5.4.1 Soil Alternatives

Five alternatives were developed for the remediation of soil at the site. The alternatives were developed to provide a range in the degree of treatment and protection.

Soil Alternative A proposes that no action be taken to remediate or control access to the site soil. This alternative would not be protective of human health or the environment. Alternative B, consisting of institutional controls, would be effective in reducing potential direct contact and ingestion of PCBs. Alternative C, institutional controls and containment, would be more effective in reducing potential risks posed by the PCBs. Deed restrictions and fencing would limit access to the site and restrict present and future use. The capping portion of this alternative involves using a asphalt cap, which would afford environmental protection by reducing potential leaching from the capped area. Alternative D involves excavation of the contaminated soil and transportation to an off-site TSCA-permitted landfill. This alternative would be protective of human health because it would permanently remove the contaminants from the site. Soil Alternative E, which includes excavation, solvent extraction, and on/off-site disposal, would be protective of human health and would afford protection to the environment by extracting contaminants from the soil. The effectiveness of this treatment would depend on the quality of the extraction process and the number of extraction stages required to achieve a concentration of 2 mg/kg.

Soil Alternatives A and B would not provide any reductions in the toxicity, mobility, or volume of PCBs except through natural processes. Alternative C would reduce PCB mobility by capping the contaminated area. Active reduction in the toxicity or the volume of the PCBs would not be achieved through Alternative C. The toxicity, mobility, and volume of PCBs would be actively reduced or eliminated by excavation along with removal (Alternative D) or on-site treatment (Alternative E) of the contaminated soil.

There are no short-term risks associated with Soil Alternative A, the no action alternative. The short-term risks to the public and the environment during implementation of Alternatives B and C would be minimal. Implementation of Alternatives D and E would present some risks to workers due to the potential for contact with contaminated soils and use of solvents (Alternative E), but would be reduced through the use of personal protective equipment and compliance with OSHA regulations.

Soil Alternative D is likely to be the most easily implemented other than the No Action Alternative. Implementation of the deed restrictions required for Alternative C is likely to be more difficult. Contracting the services required for Alternative E would be very difficult due to the low volume of soil to be treated.

No capital or O&M costs would be associated with Alternative A, and moderate capital and high O&M costs would be associated with Alternative B. Alternative C is likely to involve moderate to high capital and high O&M costs. Moderate capital and no O&M costs are likely to be associated with Soil Alternative D. Relatively high capital and no O&M costs are anticipated for Soil Alternative E.

Four soil alternatives were retained for further detailed evaluation, as presented in Section 7.0. The no action alternative, Alternative A, is retained as a baseline against which the other retained alternatives can be compared. Soil Alternative B is rejected from further analysis because it would not provide the level of protection recommended by the U.S. EPA (1990b) for the maximum PCB concentration (230 mg/kg) that was identified at the site. Alternatives C, D, and E are all retained for detailed evaluation. Alternative D appears to be the easiest to implement and the most cost-effective alternative other than no action. However, Alternatives C and E are retained as the representative alternatives that utilize containment and on-site treatment of the contaminated soil.

5.5 SUMMARY OF RETAINED ALTERNATIVES

The four groundwater alternatives retained for further evaluation in Section 6.0 are Alternatives A, B, C, and D. Alternative A is the no action alternative. Alternative B involves the use of institutional controls, consisting of deed restrictions and groundwater monitoring. Alternative C consists of institutional controls and containment using an asphalt cap. Alternative D consists of institutional controls, extraction wells, on-site treatment, and discharge to the local POTW.

The four soil alternatives that were retained for further analysis in Section 7.0 are Alternatives A, C, D, and E. Alternative A is the no action alternative. Alternative C proposes institutional controls, including deed restrictions and a security fence, and containment of contaminated soil with an asphalt cap. All contaminated soil would be excavated and disposed off-site in Alternative D. The soil would be treated on-site using a solvent extraction process in Soil Alternative E.

Table 5-5 summarizes the retained groundwater and soil alternatives.

Tables

TABLE 5-1
ASSEMBLED ALTERNATIVES FOR GROUNDWATER
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

	A	B	C	D
No Action	X			
Institutional Controls				
Groundwater Monitoring		X	X	X
Deed Restrictions		X	X	X
Containment				
Drainage Controls			X	
Asphalt Cap			X	
Collection				
Pumping Wells				X
Treatment				
Solids Removal*				X
Air Stripping				X
Disposal				
Off-Site POTW				X

* May include precipitation, flocculation/sedimentation, or filtration.

TABLE 5-2
PRELIMINARY SCREENING OF ALTERNATIVES FOR GROUNDWATER
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Alternative	Effectiveness	Implementability	Cost	Status
A. No Action	This alternative relies on natural attenuation to reduce the volume, toxicity, and mobility of contaminants. No additional protection to human health or environment.	Easily implemented.	None	Retained as a baseline
B. Institutional Controls	This alternative relies on natural attenuation to reduce the volume, toxicity, and mobility of contaminants. Controls restrict exposure to groundwater. Protective to human health and the environment.	Monitoring of groundwater and deed restrictions can be easily implemented	Low capital and O&M	Retain
C. Institutional Controls and Containment	Reduce the infiltration of surface water and its subsequent migration into the groundwater. Provides additional protection to the environment through reduction in mobility. Toxicity and volume of contaminants not reduced except through natural processes.	Cap and deed restrictions can be easily implemented.	Moderate capital; low O&M.	Retain
D. Groundwater Monitoring, Pumping Wells, On-Site Treatment, and Discharge to POTW	Effective in removing contaminants from groundwater. Provides additional protection of the environment by retarding contaminated groundwater migration. Extraction and treatment would reduce toxicity, mobility and volume of contaminants.	This alternative would be easily implemented, as all aspects of the system are readily available. Treatability testing has been performed. A permit would be required for off-site disposal.	Moderate to high capital and O&M.	Retain

TABLE 5-3
ASSEMBLED ALTERNATIVES FOR SOIL
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

	A	B	C	D	E
No Action	X				
Institutional Controls					
Deed Restrictions		X	X		
Groundwater Monitoring		X	X		
Fencing		X	X		
Containment					
Asphalt Cap			X		
Drainage Controls			X		
Treatment					
Solvent Extraction					X
Removal					
Mechanical Excavation				X	X
Disposal					
Off-Site				X	X
On-Site					X

TABLE 5-4
PRELIMINARY SCREENING OF ALTERNATIVES FOR SOIL REMEDIATION
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Alternative	Effectiveness	Implementability	Cost	Status
A. No Action	This alternative would not actively lower the volume, toxicity, or mobility of contaminants. Protection to human health or environment would not change.	Readily implementable.	None	Retained as a baseline
B. Institutional Controls	Toxicity, mobility and volume of contaminants would not actively be reduced. Provides protection to human health and the environment.	Services and materials for construction of security fence would be readily available. Facility actively undergoing expansion. Deed restrictions may affect growth.	Moderate capital; high O&M.	Reject
C. Institutional Controls and Containment	Would provide additional protection to human health and the environment. Long-term effectiveness would depend on the quality of the cap construction and maintenance. This process would provide some reduction in contaminant mobility, but would not actively reduce volume or toxicity of contaminants.	Capping materials, equipment, and services would be readily available. Facility actively undergoing expansion. Deed restrictions may affect growth.	Moderate to high capital; high O&M.	Retain

TABLE 5-4 (continued)
PRELIMINARY SCREENING OF ALTERNATIVES FOR SOIL REMEDIATION
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Alternative	Effectiveness	Implementability	Cost	Status
D. Excavation and Off-Site Disposal	This option would provide protection of human health and the environment by removing contaminated soils from the site. Effectively reduces the toxicity, mobility, and volume of on-site contaminants, which would be contained in a controlled landfill.	Easily implemented. Excavation and transportation would be readily available.	Moderate capital (includes transport and disposal costs). No O&M.	Retain
E. Excavation, Solvent Extraction, and On/Off-site Disposal	Effectiveness may be limited by need for numerous extractions to meet on-site disposal requirements (<2.0 mg/kg). Provides protection to human health and the environment. Reduces toxicity, mobility, and volume of on-site contaminants.	Materials, services and equipment would be difficult to obtain due to the small volume of soil to be treated. Treatability testing would be required for solvent extraction. Extracted PCBs would require off-site disposal.	High capital and no O&M.	Retain

6.0 DETAILED DESCRIPTION AND EVALUATION OF GROUNDWATER ALTERNATIVES

The groundwater alternatives that were screened and retained in Section 5.0 are described and evaluated in further detail in this section. The purpose of the detailed evaluation is to provide enough relevant information for each alternative so decision makers may select an appropriate remediation measure for a particular site. Each alternative is initially evaluated against the U.S. EPA-required criteria, then the alternatives are compared against each other to identify the key advantages and disadvantages of each.

The RI/FS Guidance Document (U.S. EPA, 1988c) provides nine evaluation criteria to address the CERCLA statutory requirements and considerations:

- Overall protection of Human Health and the Environment
- Compliance with ARARs
- Long-Term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume through Treatment
- Short-Term Effectiveness
- Implementability
- Cost
- State Acceptance
- Community Acceptance

The nine criteria are grouped into three categories: threshold, balancing and modifying criteria. The threshold criteria focus on how risks posed through each exposure pathway are reduced, controlled, or eliminated. The two threshold criteria are overall protection of human health and the environment, and compliance with ARARs. Balancing criteria include the next five criteria listed, and are used to further evaluate the alternatives that satisfy the threshold criteria. The modifying criteria include community and state acceptance. These criteria will be evaluated in the Record of Decision (ROD), following a review of the public comments on the RI/FS documents and the proposed plan. These criteria will not be evaluated at this time.

The main aspects of the seven criteria to be evaluated during the detailed evaluation of the groundwater alternatives are discussed below.

- Overall Protection of Human Health and the Environment: This criterion provides an overall assessment of the degree to which each alternative protects human health and the environment. The overall protectiveness focuses on whether the alternative would achieve adequate protection and how existing site risks would be eliminated, reduced or controlled through treatment, engineering, or institutional controls. Because this criterion is considered a threshold criterion, overall protection must be provided for an alternative to be considered a remedy for the site.

- Compliance with ARARs: This criterion assesses whether an alternative would meet all federal and state ARARs, including chemical, action, and location-specific ARARs. This criterion is also a threshold criterion.

- Long Term Effectiveness and Permanence: This criterion assesses the risk that would remain at the site after remedial goals are achieved. The extent and effectiveness of the controls needed to manage any treatment residuals or untreated wastes are assessed by determining the magnitude of any residual risk remaining at the site at the conclusion of the remedial activities. The adequacy and reliability of the controls used to manage treatment residuals or untreated wastes, if any, are assessed.

- Reduction of Toxicity, Mobility, or Volume through Treatment: This allows for an assessment of the degree to which hazardous substances would permanently and significantly reduce toxicity, mobility, or volume of contaminants. This assessment would be completed by analyzing the destruction of toxic contaminants, the reduction of total mass of toxic contaminants, the irreversible reduction of contaminant mobility, and the reduction of total volume of contaminated material.

- Short-Term Effectiveness: This criterion addresses the effects of an alternative during the construction and implementation of remedial activities until the remediation goals would be achieved. These include protection of workers and the community during construction and implementation, any environmental impacts that might result from the construction or implementation, and the length of time until the remediation goals would be achieved.

- Implementability: The implementability criterion assesses the technical and administrative feasibility of implementing an alternative, availability of the technologies, and the availability of various services and materials required during implementation. Technical feasibility refers to the technical difficulties and variables associated with the alternatives, the reliability of the technologies, and monitoring requirements. Administrative feasibility includes the activities which require coordination with regulatory offices or agencies.

- Cost: The cost evaluation includes capital costs, annual O&M costs, and a present worth analysis. The cost estimates are order-of-magnitude level estimates, as defined by the American Association of Cost Engineers. The costs estimates are approximate estimates made without engineering data. Typically, an estimate of this type is expected to be accurate to +50% and -30% for unit quantities. The actual cost would depend on the final scope of the remedial action, the implementation schedule, actual labor and material costs, competitive market conditions, and other variables that may affect project cost. Detailed cost estimates were prepared in accordance with the U.S. EPA's Remedial Action Costing Procedures Manual (U.S. EPA, 1987).

6.1 GROUNDWATER ALTERNATIVE A: NO ACTION

Alternative A would not involve any remedial actions, and the site would remain in its current condition. This alternative is required by the NCP and CERCLA/SARA as a baseline against which the effectiveness of other alternatives can be compared.

6.1.1 Overall Protection of Human Health and the Environment

The no action alternative would not provide any additional protection to human health and the environment because no remedial activities would be conducted. The potential for ingestion of or direct contact with contaminated groundwater would remain. Natural degradation and dilution of contaminants is expected over time.

6.1.2 Compliance with ARARs

Alternative A would not ensure that chemical-specific ARARs are met at the boundary of the manufacturing area. Compliance with action-specific ARARs would not be required because no remedial actions would be performed. No location-specific ARARs are associated with this alternative.

6.1.3 Long-Term Effectiveness and Permanence

The residual risks to human health and the environment associated with the no action alternative would be the same as the current risks. Natural degradation and dilution of the contaminants is likely to occur. An evaluation of the adequacy and reliability of controls implemented is not applicable to this alternative. Since no groundwater monitoring would be performed, there would be no mechanism to evaluate the protectiveness of the alternative.

6.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

No active treatment would be conducted at the site. However, there would be a reduction of toxicity, mobility, and volume of contaminants through natural attenuation.

6.1.5 Short-Term Effectiveness

There would be no increase in short-term risk to workers or the community associated with Alternative A, as no remedial actions would be conducted. No environmental impacts would occur as a result of construction or implementation. Remediation goals are not currently exceeded at or beyond the boundary of the manufacturing area.

6.1.6 Implementability

This criterion is not applicable.

6.1.7 Cost

No capital or O&M costs would be incurred through implementation of the no action alternative.

6.2 GROUNDWATER ALTERNATIVE B: INSTITUTIONAL CONTROLS

Alternative B, institutional controls, was developed to monitor the groundwater conditions and restrict present and future use of the groundwater in the manufacturing area. Deed restrictions would prohibit consumptive use of the groundwater originating in the manufacturing area. Deed restrictions would also prevent the construction of new wells in this area.

Groundwater monitoring would be performed in the courtyard and at the perimeter of the manufacturing area. The five monitoring wells in the courtyard where contaminants have been identified exceeding remediation goals (MW-1-1, MW-1-2, MW-1-3, MW-1-4, and PTW-1) would be monitored. Five manufacturing-area perimeter wells will also be monitored as part of this alternative. These wells would include existing Lower Ocala wells DRW-9, DRW-7A, and DRW-11 and two additional Lower Ocala wells to be installed. The proposed locations of these wells, along with the existing wells to be monitored are shown in Figure 6-1. The wells will be installed in a manner similar to the existing Lower Ocala monitoring wells. Monitoring would be performed to evaluate the process of natural attenuation to restore groundwater quality. Monitoring would also serve to identify water quality changes at the boundary of the manufacturing area. Monitoring would be conducted on a quarterly basis for the first year, and semi-annually thereafter until the remediation goals are achieved in all wells or the decrease in contaminant concentrations is shown to be asymptotic for the courtyard monitoring wells for four consecutive sampling events, whichever is sooner. Deed restrictions would be terminated at the end of the monitoring period.

The groundwater samples will be submitted for laboratory analysis for VOCs by Method 8240. If any chemicals to be remediated are detected in the same perimeter monitoring well at a concentration equal to the chemicals remediation goal for four consecutive quarterly sampling events or two semi-annual events, an expanded monitoring program would be implemented. The information obtained through the expanded program would be used to develop a more active remedial program.

6.2.1 Overall Protection of Human Health and the Environment

Alternative B would provide protection to both human health and the environment. The deed restrictions would prevent potential human contact with and ingestion of groundwater. By prohibiting the installation of new wells, deed restrictions would also prevent the potential for cross-contamination of the groundwater zones and an increased hydraulic gradient due to pumping. The alternative would also provide protection to the environment by providing a mechanism for preventing the migration of contaminants to or beyond the boundary of the manufacturing area.

6.2.2 Compliance with ARARs

Groundwater Alternative B would comply with pertinent chemical and action-specific ARARs. The chemical-specific ARARs considered for this alternative include:

- Safe Drinking Water Act - The SDWA establishes MCLs and MCLGs for a variety of contaminants in drinking water. MCLs are relevant and appropriate for groundwater used as a drinking water source. MCLGs are the maximum level for a contaminant in drinking water at which no adverse effect on health would occur. MCLGs are nonenforceable, but MCLGs that are greater than zero are considered ARARs for groundwater used as a drinking water source.

- Georgia Rules for Safe Drinking Water - The established maximum safe drinking water contaminant levels (Rules and Regulations of the State of Georgia, Title 391, Chapter 3, Rule 5) are equal to those established by the Federal SDWA.

- Georgia Water Quality Control Act - Standards and procedures established by the Georgia Water Quality Control Act would be applicable if they are more stringent than federal regulations.

The following are action-specific ARARs that are considered applicable to Groundwater Alternative B.

- Occupational Safety and Health Act - All field activities, including monitoring well installation and groundwater sampling and monitoring, would be performed in accordance with 40 CFR Part 50 regulations governing construction activities and activities at hazardous waste sites.

No location-specific ARARs are associated with this alternative.

6.2.3 Long-Term Effectiveness and Permanence

This alternative would be an effective method to protect human health and the environment by implementing institutional controls. The deed restrictions would be effective in preventing the present and future use of groundwater in the manufacturing area and the installation of wells through the Residuum. Monitoring of the groundwater would also be an effective method for monitoring any potential migration of contaminants beyond the boundary of the manufacturing area.

6.2.4 Reduction of Toxicity, Mobility or Volume Through Treatment

No active treatment would be implemented at the site; however, there would be reduction in toxicity, mobility, and volume through natural attenuation. Data that have been collected at the site indicate that the VOC concentrations that exceed the remediation goals have not migrated any lower than the depth of the Residuum and Transition Zone wells.

6.2.5 Short-Term Effectiveness

There would be no increase in short-term risk to the community associated with Alternative B, as no remedial actions would be conducted. The risk to workers would be minimal during well installation and groundwater sampling, and would be reduced by compliance with OSHA regulations. No environmental impacts would occur as a result of implementation. The remedial goals are not currently exceeded at or beyond the boundary of the manufacturing area.

6.2.6 Implementability

Alternative B would be readily implemented at the site. Deed restrictions could be readily obtained through the local court system. Sampling and analysis of the groundwater would also be easily implemented.

6.2.7 Cost

A detailed cost estimate of capital costs for Alternative B is presented in Table 6-2. The detailed summary for O&M costs and the total present worth is presented in Table 6-3.

The total capital cost includes direct and indirect capital costs. The direct capital cost would include the installation of the groundwater monitoring wells. The indirect capital costs include obtaining deed restrictions. The total capital is estimated to be $69,375.

The O&M costs associated with implementing this alternative include any required enforcement of deed restrictions and groundwater sampling and analysis. Annual costs for the first year are estimated to be $32,480 and $16,240 per year thereafter. Considering a maximum performance period of 30 years for costing purposes, the total present worth of Alternative B, using the assumptions presented in Table 6-1, is estimated to be $334,490.

6.3 GROUNDWATER ALTERNATIVE C: INSTITUTIONAL CONTROLS AND CONTAINMENT

Groundwater Alternative C involves implementation of the institutional controls of deed restrictions, groundwater monitoring, and installation of an asphalt cap. The cap would extend over the areas of known groundwater contamination. Deed restrictions and monitoring of the groundwater would be implemented as described for Groundwater Alternative B. The cap would serve to inhibit the infiltration of surface water in the courtyard area, thereby reducing the potential for migration of contaminants. Groundwater monitoring would be used to monitor the effectiveness of the cap and the natural attenuation process.

The area that would be capped is shown in Figure 6-2. This area includes areas that are currently grass or asphalt-covered. Figure 6-3 illustrates the conceptual design for the cap.

The final design for the asphalt cap will be established after contacting the Georgia Department of Transportation (DOT) regarding typical designs for parking areas. This section describes a typical design. A 4-in.-thick graded aggregate subbase would be placed over the native soil subgrade. On top of the aggregate subbase, a 4-in. layer of asphalt wearing course would be laid. The top layer, or surface course, would consist of a 2-in. layer of asphalt. Existing paved areas will be inspected and cracks will be repaired. Permeabilities as low as 1×10^{-9} cm/sec have been achieved with asphalt (Devinney et al., 1990). Additional evaluation of the cap would be conducted during remedial design to provide optimum reduction in surface water infiltration.

A semi-annual inspection would be performed to check for cracking and wear. In the instance that the cap is found to have cracked or is excessively worn, the appropriate repairs would be made by a qualified contractor.

As described for Alternative B, monitoring would be conducted on a quarterly basis for the first year, and semi-annually thereafter until the remediation goals are achieved in all wells or the decrease in contaminant concentrations is shown to be asymptotic for the courtyard monitoring wells for four consecutive sampling events, whichever is sooner.

Deed restrictions and cap maintenance would be terminated at the end of the monitoring period.

The groundwater samples will be submitted for laboratory analysis for VOCs by Method 8240. If any chemicals to be remediated are detected in the same perimeter monitoring well at a concentration equal to the remediation goal for four consecutive quarterly sampling events or two semi-annual events, an expanded monitoring program would be implemented. The information obtained through the expanded program would be used to develop a more active treatment program.

6.3.1 Overall Protection of Human Health and the Environment

Groundwater Alternative C would provide protection to both human health and the environment. The cap would inhibit surface water infiltration and off-site migration of contaminated groundwater. As the inflow of surface water into the area of contamination is decreased, the vertical movement of the groundwater will be inhibited. However, this reduction of inflow may also inhibit the natural attenuation process.

6.3.2 Compliance with ARARs

Groundwater Alternative C would comply with pertinent chemical and action-specific ARARs. The chemical-specific ARARs considered for this alternative are as follows:

- Safe Drinking Water Act - The SDWA establishes MCLs and MCLGs for a variety of contaminants in drinking water. MCLs are relevant and appropriate for groundwater used as a drinking water source. MCLGs are the maximum level for a contaminant in drinking water at which no adverse effect on health would occur. MCLGs are non-enforceable, but MCLGs that are greater than zero are considered ARARs for groundwater used as a drinking water source.

- Georgia Rules for Safe Drinking Water - The established maximum safe drinking water contaminant levels (Rules and Regulations of the State of

Georgia, Title 391, Chapter 3, Rule 5) are equal to those established by the Federal SDWA.

- Georgia Water Quality Control Act - Standards and procedures established by the Georgia Water Quality Control Act would be applicable if they are more stringent than federal regulations.

The following are action-specific ARARs are considered applicable to Groundwater Alternative C.

- Occupational Safety and Health Act - All field activities, including groundwater sampling and monitoring would be performed in accordance with 40 CFR Part 50 regulations governing construction activities and activities at hazardous waste sites.

6.3.3 Long-Term Effectiveness

This alternative would reduce the potential for contaminant migration from the contaminated area. The cap would enhance surface water run-off away from the areas of contamination and inhibit surface water infiltration.

Long-term maintenance would include periodic inspection and maintenance of the cap to insure its integrity and impermeability. The long-term reliability of the cap would be adequate if it is properly designed, installed, and maintained.

Groundwater monitoring would be an effective mechanism for evaluating the effectiveness of the cap and the natural attenuation process in restoring groundwater quality. Deed restrictions would effectively protect human health by preventing use of the groundwater.

6.3.4 Reduction of Toxicity, Mobility or Volume Through Treatment

No active treatment would be conducted as part of this alternative. Natural attenuation of the contaminants would result in a reduction of toxicity, mobility, and volume of contaminants. The cap would also reduce the mobility of the contaminants by inhibiting the infiltration of surface water.

6.3.5 Short-Term Effectiveness

Remediation goals are not currently exceeded at or beyond the boundary of the current manufacturing area. Risks posed to the community and the environment during the construction of the cap would be minimal. Because workers would not come into contact with the contaminated groundwater during construction of the cap, no special measures would be required to protect the workers. Any potential risk would be reduced through compliance with OSHA requirements during construction. Access to the site by unauthorized people would be restricted. No adverse environmental impacts associated with this alternative are expected.

6.3.6 Implementability

Construction of the asphalt cap would be completed using conventional methods. Some difficulties may be encountered due to existing structures and utilities. Contractors to perform the installation would be readily available. Materials for the construction of the cap would be readily available also, and may be obtained from local vendors. No technical problems have been identified with construction that might lead to schedule delays. The effectiveness of the cap would be monitored by collecting and analyzing groundwater samples from monitoring wells located at the site. Implementing the groundwater monitoring portion of the alternative would not be difficult.

If additional monitoring wells are required in the area of the cap, drilling should be completed prior to the installation of the cap to avoid harming its integrity. If wells are drilled after the installation of the cap, watertight connections between the cap and the well casings would be required.

Obtaining deed restrictions to restrict consumptive use of the groundwater in the manufacturing area is not expected to be difficult. The installation of groundwater monitoring wells would be conducted using conventional methods, and should not present any special difficulties. Services required for well installation would be readily available.

6.3.7 Cost

The detailed cost estimate of the capital costs for Groundwater Alternative C is presented in Table 6-4, which presents the construction costs for each major component of this alternative. A detailed cost summary for the O&M costs and the total present worth of this alternative is presented in Table 6-5.

The capital costs include both direct and indirect costs. The direct costs include preparation of the site, construction of the asphalt cap, and any necessary drainage controls and the installation of the groundwater monitoring wells. The total capital costs are estimated to be $223,438. The O&M costs associated with implementing Groundwater Alternative C include cap inspection and maintenance, and sampling and analysis of groundwater. These annual costs are estimated to be $40,480 for the first year and $24,240 for the following years. Considering a maximum performance period of 30 years for costing purposes, the total present worth of this alternative is estimated to be $611,533.

6.4 GROUNDWATER ALTERNATIVE D: INSTITUTIONAL CONTROLS, PUMPING WELLS, ON-SITE TREATMENT, AND DISCHARGE TO POTW

Groundwater Alternative D consists of institutional controls, extraction of groundwater from pumping wells, on-site treatment to ARARs, and off-site discharge of the treated water to the local POTW. The City of Albany POTW pretreatment requirements must be met prior to discharge to the POTW.

Recent pumping records for extraction wells PTW-1 and MW-1-3 during April, May, and June 1992 have indicated a combined well yield of approximately 0.2 gpm. Groundwater level measurements have been collected during the pumping activities from Residuum/Transition Zone wells located at distances of approximately 15 to 200 ft from the pumping wells. The lack of observable pumping influence at wells located as little as 15 ft away is attributed to heterogeneities in the Residuum, including discontinuous, perched water-bearing zones and relict fractures, which may result in preferential flow pathways. Irregularities in the upper surface of the Transition Zone may also create anomalous flow patterns.

In lieu of a gridded network installed irrespective of site heterogeneities, existing monitoring wells where contamination has been identified at concentrations that exceed remediation goals would be used for extraction purposes. Each well would be equipped with a low-volume, down-hole pump that could also be used for sampling purposes.

It is estimated that each of the existing wells to be used for groundwater extraction would produce a yield of approximately 0.1 gpm. The wells would discharge to a piping system routed to the on-site treatment area.

The initial pumping would be conducted to extract groundwater for treatment of VOCs in the courtyard area. Five existing wells (MW-1-1, MW-1-2, MW-1-3, MW-1-4, and PTW-1) would be used to extract groundwater from the courtyard area.

The extracted groundwater would be treated to the City of Albany POTW discharge requirements prior to discharge. Air stripping would be used to remove VOCs. The total flow from the extraction system is estimated to be 0.5 gpm. Using the maximum concentrations obtained during the RI for the proposed courtyard area pumping wells (MW-1-1, MW-1-2, MW-1-3, MW-1-4, and PTW-1), the maximum total influent VOCs are estimated to be 2.5 mg/l. This influent concentration and flow rate result in an initial daily mass transfer of about 0.002 lbs of VOCs per day. Over time, this mass would decrease.

Based on the estimated flow rate and the estimated influent VOC concentration, the existing collection/aeration tank could be used for the air stripping. The current tank configuration has a holding capacity of approximately 7,000 gallons, which would result in a retention time of approximately 10 days. The collection/aeration tank is currently being used to treat the VOCs from MW-1-3 and PTW-1. Analytical results for discharge monitoring conducted from January 1992 through June 1992 indicated that the VOCs have been removed to below method detection limits using U.S. EPA Methods 601 and 602. A pilot test would be performed to evaluate the effectiveness of the collection/aeration tank with the additional influent. If required, additional air stripping equipment would be added to comply with the local POTW's discharge limits. Results of the groundwater treatability study indicate that the contaminants of concern in the courtyard area wells could be treated to City of Albany POTW discharge limits in a packed tower air stripper having a 12-in. diameter, 6 ft of packing, and an air-to-water ratio of 100 to 1 (WCC, 1992b). Other types of stripping systems, such as sparging tanks and low-profile strippers may also be used to successfully reach discharge requirements.

The collection/aeration tank would serve also to oxidize and precipitate iron from the water. The removal of iron is likely to be required to meet the City of Albany POTW discharge limits. Following the collection/aeration tank, the treated water would pass through a filtration system to remove the oxidized iron from the water. The treated effluent would then pass through any additional air stripping equipment and would be routed to the POTW. It is assumed that off-site discharge would require the daily collection of an effluent sample during the first week of operation and on a monthly frequency thereafter.

A conceptual process flow diagram for Alternative D is presented as Figure 6-4. For the purposes of developing and evaluating this alternative, the system was designed to treat a relatively low flow rate, consistent with the low well yields at this site. The treatment system, not including the extraction and disposal components, would consist of the following:

- Automatic controls/flow meter
- Collection/aeration tank
- Additional air stripping equipment, if required
- Solids removal equipment
- Effluent sampling location
- Associated piping and pumping equipment

The treatment system would be automated so that a full-time operator would not be required. In the event of a system failure, a high-high level switch would shut off the well pumps so that the collection tank would not become over-filled.

Currently, it is Georgia DNR policy to require BACT on air emissions from RCRA/CERCLA sites. Therefore, the tank may need to be vented to a vapor-phase GAC system to remove VOCs.

Groundwater Alternative D also includes periodic and continued groundwater monitoring to identify changes in contaminant concentrations and evaluate the effectiveness of the extraction and treatment system. The groundwater monitoring program would be conducted as described for Alternative B and would include the five pumping wells and five perimeter wells. Two additional wells would be installed at the boundary of the manufacturing are for this alternative. All samples would be analyzed for VOCs by Method 8240. Appropriate duplicates and field blanks would be collected.

Groundwater extraction and treatment would continue until the chemicals to be remediated are not detected above the remediation goals in all wells for 1 year, or until an asymptotic decrease in contaminant concentration is shown for at least 4 consecutive sampling events, whichever is sooner. At that time, extraction would be discontinued and semi-annual groundwater sampling and analysis would continue for an additional 3-year period. If, at any time, chemicals are detected above the remediation goals, extraction would resume. This pulsed pumping may result in a greater removal of contaminants from the groundwater by allowing the diffusion of contaminants during nonpumping periods from stagnant or less permeable areas of the aquifer to the area being actively pumped. For the purpose of estimating the costs associated with this alternative, the length of treatment was assumed to be 30 years of continuous pumping and monitoring.

With this alternative, the wastes produced from the treatment process include the solid wastes from the tank, solids removal processes, spent vapor-phase GAC, and the periodic maintenance activities performed on the air-stripping system. These wastes would be characterized and disposed appropriately.

Deed restrictions would also be implemented as an additional institutional controls in Alternative D. Deed restrictions would be established so as to restrict present and future consumptive use of the groundwater, as described for Alternative B.

6.4.1 Overall Protection of Human Health and the Environment

This alternative would protect human health from the risks posed by contaminated groundwater at the site through continuous collection and treatment of groundwater. The extraction would inhibit the migration of contaminated groundwater from the contaminated area. Deed restrictions would provide additional protection to human health. Emissions from the air stripper would be treated using vapor-phase GAC; therefore, no VOCs would be released to the atmosphere. Additional protection of the environment would be provided by removal of contaminants from the groundwater. Off-site disposal of pretreatment solids would not represent a significant risk because these solids are not expected to exhibit the characteristics of a hazardous waste.

6.4.2 Compliance with ARARs

Groundwater Alternative D would comply with pertinent chemical and action-specific ARARs. The chemical-specific ARARs considered for this alternative are as follows:

- Safe Drinking Water Act - The SDWA establishes MCLs and MCLGs for a variety of contaminants in drinking water. MCLs are relevant and appropriate for groundwater used as a drinking water source. MCLGs are the maximum level for a contaminant in drinking water at which no adverse effect on health would occur. MCLGs are nonenforceable, but MCLGs that are greater than zero are considered ARARs for groundwater used as a drinking water source.

- Georgia Rules for Safe Drinking Water - The established maximum safe drinking water contaminant levels (Rules and Regulations of the State of Georgia, Title 391, Chapter 3, Rule 5) are equal to those established by the Federal SDWA.

- Georgia Water Quality Control Act - Standards and procedures established by the Georgia Water Quality Control Act would be applicable if they are more stringent than federal regulations.

The following are action-specific ARARs are considered applicable to Groundwater Alternative D.

- Occupational Safety and Health Act - All field activities, including groundwater sampling and monitoring would be performed in accordance with 40 CFR Part 50 regulations governing construction activities and activities at hazardous waste sites.

- Resource Conservation and Recovery Act - The remedial activities would be performed in compliance with all applicable provisions of RCRA. The Land Disposal Restriction of 40 CFR Part 268 would have to be met for the wastes generated during the treatment processes if they are identified as RCRA characteristic wastes. Treatment wastes would be tested using TCLP protocol for identification, and appropriate measures would be implemented to comply with these restrictions, if required.

- Occupational Safety and Health Act - All field activities, including drilling, trenching, equipment installation, sampling and monitoring would be performed in accordance with 40 CFR Part 50 regulations governing construction activities and activities at hazardous waste sites.

- Georgia Water Quality Control Rules - Chapter 391-3-6, Section 08 of the Water Quality Control Rules provides standards for wastewater treatment prior to discharge into the POTW and then into waters of the State. Treated groundwater would be treated so as to comply with these standards.

- Georgia Air Quality Control Rules - Provides regulation for air emission sources. All air emissions produced at the site would comply with the standards established by this act (Rules and Regulations of the State of Georgia, Chapter 391-3-1), which include ambient air standards, new source performance standards, prevention of significant deterioration of air quality and emissions standards for hazardous air pollutants.

- City of Albany Sewerage Ordinance - This establishes standards for discharge to the sewer system. These standards would set the treatment level goals for groundwater treatment prior to discharge to the POTW. A permit must be issued prior to discharge to the POTW.

There are no location-specific ARARs associated with this alternative. To-be-considered (TBC) guidance specifically addressed in this alternative include the following:

- Georgia DNR Policy - This alternative was developed under the assumption that BACT would be required for any air emissions. Vapor-phase GAC would be used to control all air emissions.

6.4.3 Long-Term Effectiveness and Permanence

Treatment of the groundwater through the use of an air stripper would permanently and effectively remove VOCs from the groundwater. If, during remedial design, any process is shown to be ineffective in treating the groundwater at the site, other technologies screened and discussed in Sections 4.0 and 5.0 would be considered for use. Groundwater monitoring would be an effective mechanism for evaluating the effectiveness of the pumping in restoring groundwater quality. Deed restrictions would effectively protect human health by preventing use of the groundwater.

Long-term O&M activities associated with Groundwater Alternative D would include repair and maintenance of pumping wells and treatment system equipment, daily operational activities such as addition of any required chemical additives, waste handling, and sampling and analysis of groundwater and effluent. No difficulties or uncertainties are expected during the performance of these activities. The need for replacement of equipment such as pumps or the aeration system would be minimal if properly maintained.

6.4.4 Reduction of Toxicity, Mobility or Volume Through Treatment

Extraction and treatment would actively reduce the toxicity, mobility, and volume of the contaminants present in the groundwater. The residuals generated by the solids removal process or spent GAC would be disposed in an off-site landfill, incinerated or regenerated for further use. Some risk would remain if the residuals are disposed in a landfill.

6.4.5 Short-Term Effectiveness

Community risk associated with Groundwater Alternative D would be low during installation of the monitoring wells and the extraction and treatment system. The risk would be somewhat greater for the workers installing the wells. This risk would be reduced through compliance with all applicable OSHA requirements and guidelines for hazardous waste site activities. Remediation goals are not currently exceeded at or beyond the boundary of the manufacturing area.

6.4.6 Implementability

Conversion of monitoring wells to extraction wells and construction of the treatment system would be relatively easy using established procedures, and contractors specializing in that type of work would be readily available. Electricity would be required to run the system and is available at the site. Some problems may be encountered in locating wells and below-grade piping due to the presence of utilities and above-grade structures. Technical problems are not expected to result in schedule delays during remediation because a system currently exists for the treatment technology included in Alternative D.

The use of air stripping to remove organics from groundwater is a proven and reliable technology. The groundwater may require pretreatment such as solids removal prior to the primary treatment due to the water quality at the site. This need will be determined during the remedial design. The system would be automated so that a full-time operator would not be required.

All of the technologies included in this alternative would be readily available. Permits for discharge are required for this alternative. The permit required for off-site discharge would be obtained from the local POTW. All applicable discharge requirements must be met prior to the issuance of a permit. Meeting the off-site discharge requirements should be easily accomplished through the technologies as indicated by the current system performance. The actual application and permitting process may be lengthy due to the complicated nature of the process.

If required, additional remedial actions at the site would be easy to implement. Regular groundwater and effluent sampling and analysis would be a sufficient means to determine the effectiveness of the extraction and treatment system.

Deed restrictions are expected to be readily implementable.

6.4.7 Cost

A detailed cost estimate of capital costs for Alternative D is presented in Table 6-6. The detailed summary for O&M costs and the total present worth is presented in Table 6-7.

The total capital cost includes both direct and indirect capital costs. The direct capital costs include installation of the pumping equipment, construction of the treatment system and associated discharge piping, and the purchase of equipment. These costs are estimated to be $162,400. Indirect costs include the treatment system design, permitting and contingencies and total $126,650. The total capital is estimated to be $289,050.

The O&M costs associated with implementing this alternative include maintenance of the groundwater extraction and treatment system, solids disposal, periodic cleaning of the system, and groundwater and effluent monitoring. Annual costs for the first year are estimated to be $128,980 and $101,740 per year thereafter. Considering a maximum performance period of 30 years for costing purposes, the total present worth of Alternative D, using the assumptions presented in Table 6-1, is estimated to be $1,878,986.

Tables

TABLE 6-1
BASIS OF COST ESTIMATES
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Cost Estimate Elements

- Estimation of Capital Cost
- Estimation of Operation and Maintenance Costs
- Present Worth Analysis

Definition of Elements

- Capital Costs

  Direct Capital Costs: Includes expenditures for the equipment, labor, and materials required to implement the remedial actions. Direct capital costs considered include but are not limited to construction, equipment, site preparation, buildings and services, transportation, and disposal costs.

  Indirect Capital Costs: Includes expenditures for engineering, permitting, legal, and other services that are not part of the actual installation activities but are required to complete the implementation of remedial alternatives. Indirect capital costs include but are not limited to bid and scope contingencies, permitting and legal costs, construction services, and engineering and design costs.

- Operation and Maintenance Costs: Annual post-construction costs necessary for the continued effectiveness of the remedial actions. Types of remedial action costs considered are continued monitoring and routine maintenance.

- Present Worth Analysis: Used to evaluate expenditures that occur over different time periods by discounting all future costs to common base year. This allows the costs of the remedial alternatives to be compared on the basis of a single figure representing the amount of money that would be sufficient to cover all costs associated with each remedial action over its expected life.

TABLE 6-1 (Continued)
BASIS OF COST ESTIMATES
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Assumptions

- Economic life of each remedial action will not be greater than 30 years, and no salvage value will be credited at the end of the life of the alternative.
- Discount rate will be 5 percent before taxes.
- Costs are in 1992 dollars.
- The annual rate of inflation is incorporated into the discount rate.
- Capital costs occur in Year 0.
- O&M costs occur throughout the life of the remedial alternative.
- Scope contingency, which covers changes in scope such as change orders and changes in design and implementation, are 25 percent of the direct capital subtotal.
- Permitting and legal costs, which include supervision and administration along with engineering and design during construction, are 10 percent of the total direct capital costs (including contingencies).
- Construction service costs, which include supervision and administration along with engineering and design during construction are 15 percent of total direct capital costs (including contingencies).
- Engineering design costs, which include design and process development, preparation of specification and bid documents, drafting, and monitoring and testing are 20 percent of total direct and indirect capital costs (including contingencies, permitting and legal costs, and construction service costs).

TABLE 6-2
GROUNDWATER ALTERNATIVE B
INSTITUTIONAL CONTROLS
CAPITAL COST ESTIMATE

REMEDIAL ACTIVITY	QUANTITY	UNIT	UNIT COST	TOTAL COST
GROUNDWATER MONITORING				
Installation of Monitoring Wells	2	well	15000.00	$30,000
DIRECT COST SUBTOTAL				$30,000
SCOPE CONTINGENCIES				7,500
ENGINEERING DESIGN				6,000
CONSTRUCTION TOTAL				$43,500
PERMITTING AND LEGAL				4,350
CONSTRUCTION SERVICES				6,525
TOTAL IMPLEMENTATION COST				$54,375
INSTITUTIONAL CONTROLS				
Deed Restrictions	1	ls	15000.00	$15,000
TOTAL CAPITAL COST				$69,375

TABLE 6-3
GROUNDWATER ALTERNATIVE B
INSTITUTIONAL CONTROLS
OPERATION AND MAINTENANCE COST/TOTAL PRESENT WORTH ESTIMATE

REMEDIAL ACTIVITY	QUANTITY	UNIT	UNIT COST	ANNUAL COST YEAR 1	ANNUAL COST YEAR 2-30
GROUNDWATER MONITORING - YEAR 1					
Quarterly sampling of 10 wells for volatile organics (Method 8240), plus duplicate and field blank	48	sample	260.00	12,480	
Field Personnel and Reporting	4	event	5000.00	20,000	
				$32,480	
GROUNDWATER MONITORING - YEAR 2-30					
Semi-annual sampling of 10 wells for volatile organics (Method 8240), plus duplicate and field blank	24	sample	260.00		6,240
Field Personnel and Reporting	2	event	5000.00		10,000
					$16,240
ANNUAL OPERATION AND MAINTENANCE - GROUNDWATER ALTERNATIVE B					
YEAR 1				$32,480	
YEAR 2-30					$16,240
CAPITAL COST (From Table 6-2)					$69,375
TOTAL PRESENT WORTH - GROUNDWATER ALTERNATIVE B					**$334,490**

Assuming 5 Percent Discount Rate for 30 Years;
Groundwater Monitoring for 30 Years

TABLE 6-4
GROUNDWATER ALTERNATIVE C
INSTITUTIONAL CONTROLS AND CONTAINMENT
CAPITAL COST ESTIMATE

REMEDIAL ACTIVITY	QUANTITY	UNIT	UNIT COST	TOTAL COST
CAP CONSTRUCTION				
Site Preparation	1	ls	5000.00	$5,000
Materials and Installation	1	ls	85000.00	$85,000
				$90,000
GROUNDWATER MONITORING				
Installation of Monitoring Wells	2	*well*	15000.00	$30,000
DIRECT COST SUBTOTAL				$115,000
SCOPE CONTINGENCIES				28,750
ENGINEERING DESIGN				23,000
CONSTRUCTION TOTAL				$166,750
PERMITTING AND LEGAL				16,675
CONSTRUCTION SERVICES				25,013
TOTAL IMPLEMENTATION COST				$208,438
INSTITUTIONAL CONTROLS				
Deed Restrictions	1	ls	15000.00	$15,000
TOTAL CAPITAL COST				$223,438

TABLE 6-5
GROUNDWATER ALTERNATIVE C
INSTITUTIONAL CONTROLS AND CONTAINMENT
OPERATION AND MAINTENANCE COST/TOTAL PRESENT WORTH ESTIMATE

REMEDIAL ACTIVITY	QUANTITY	UNIT	UNIT COST	ANNUAL COST YEAR 1	ANNUAL COST YEAR 2-30
GROUNDWATER MONITORING - YEAR 1					
Quarterly sampling of 10 wells for volatile organics (Method 8240), plus duplicate and field blank	48	sample	260.00	12,480	
Field Personnel and Reporting	4	event	5000.00	20,000	
				$32,480	
GROUNDWATER MONITORING - YEAR 2-30					
Semi-annual sampling of wells for volatile organics (Method 8240), plus duplicate and field blank	24	sample	260.00		6,240
Field Personnel and Reporting	2	event	5000.00		10,000
					$16,240
CAP MAINTENANCE	2	event	4000.00	8,000	8,000
ANNUAL OPERATION AND MAINTENANCE - GROUNDWATER ALTERNATIVE C					
YEAR 1				$40,480	
YEAR 2-30					$24,240
CAPITAL COST (From Table 6-4)					$223,438
TOTAL PRESENT WORTH - GROUNDWATER ALTERNATIVE C					**$611,533**

Assuming 5 Percent Discount Rate for 30 Years;
Groundwater Monitoring for 30 Years

TABLES\ALBANY\6-5

TABLE 6-6
GROUNDWATER ALTERNATIVE D
GROUNDWATER PUMPING/AIR STRIPPING TREATMENT
CAPITAL COST ESTIMATE

REMEDIAL ACTIVITY	QUANTITY	UNIT	UNIT COST	TOTAL COST
GROUNDWATER MONITORING				
Montoring Well Installation	2	well	15000.00	30,000
GROUNDWATER SYSTEM INSTALLATION				
Piping to Treatment System	1250	lin ft	20.00	25,000
Well Pumps	5	each	2000.00	10,000
				$35,000
GROUNDWATER TREATMENT SYSTEM INSTALLATION				
Installation/Start-up of System	1	ls	50000.00	50,000
Internal Piping	100	lin ft	20.00	2,000
Internal Pumping Equipment	3	each	2000.00	6,000
Controls/Flow Meters	1	ls	5000.00	5,000
Collection Tank Modification	1	ls	5000.00	5,000
Solids Removal Equipment	1	ls	10000.00	10,000
Vapor-Phase GAC (200 lb)	2	each	700.00	1,400
Air Heater	1	each	6000.00	6,000
Air Stripper	1	each	12000.00	12,000
				$97,400
DIRECT COST SUBTOTAL				$162,400
SCOPE CONTINGENCIES				40,600
ENGINEERING DESIGN				54,810
CONSTRUCTION TOTAL				$203,000
PERMITTING AND LEGAL				20,300
CONSTRUCTION SERVICES				30,450
START-UP CONTINGENCY				20,300
TOTAL IMPLEMENTATION COST				$274,050
INSTITUTIONAL CONTROLS				
Deed Restrictions	1	ls	15000.00	$15,000
TOTAL CAPITAL COST				$289,050

TABLE 6-7
GROUNDWATER ALTERNATIVE D
GROUNDWATER PUMPING/AIR STRIPPING TREATMENT
OPERATION AND MAINTENANCE COST/TOTAL PRESENT WORTH ESTIMATE

REMEDIAL ACTIVITY	QUANTITY	UNIT	UNIT COST	ANNUAL COST YEAR 1	ANNUAL COST YEAR 2-30
GROUNDWATER MONITORING - YEAR 1					
Quarterly sampling of 10 wells for volatile organics (Method 8240), plus duplicate and field blank	48	sample	260.00	12,480	
Field Personnel and Reporting	4	event	5000.00	20,000	
				$32,480	
GROUNDWATER MONITORING - YEAR 2-30					
Semi-annual sampling of 10 wells for volatile organics (Method 8240), plus duplicate and field blank	24	sample	260.00		6,240
Field Personnel and Reporting	2	event	5000.00		10,000
					$16,240
EQUIPMENT REPAIR AND REPLACEMENT					
Pumps, Treatment Process Equipment, etc.	12	month	800.00	9,600	$9,600
OPERATIONAL COSTS					
Vapor-phase GAC Replacement	10	canister	700.00	7,000	7,000
Electrical	12	month	1000.00	12,000	12,000
				$19,000	$19,000

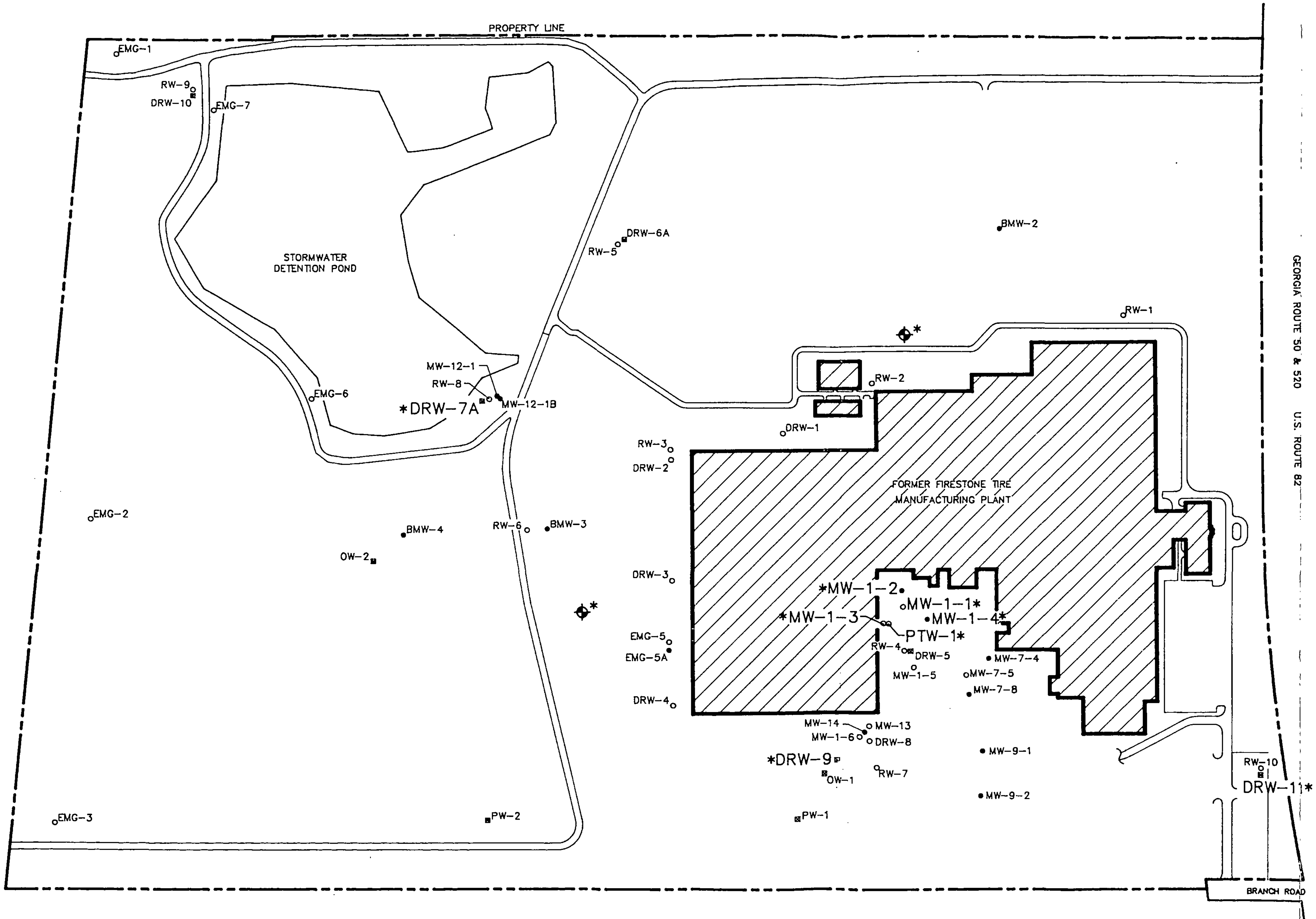
TABLE 6-7
GROUNDWATER ALTERNATIVE D
GROUNDWATER PUMPING/AIR STRIPPING TREATMENT
OPERATION AND MAINTENANCE COST/TOTAL PRESENT WORTH ESTIMATE

REMEDIAL ACTIVITY	QUANTITY	UNIT	UNIT COST	ANNUAL COST YEAR 1	ANNUAL COST YEAR 2-30
WASTE DISPOSAL COSTS YEAR 1-30					
Transportation of GAC	4	trip	1500.00	6,000	6,000
Vapor-Phase GAC Disposal	10	canister	350.00	3,500	3,500
Carbon Acceptance Fee	1	ls	5000.00	5,000	
Solids Transportation	4	trip	1000.00	4,000	4,000
Solids Disposal	12	cu yd	400.00	4,800	4,800
				$23,300	$18,300
PERSONNEL TO MAINTAIN SYSTEM - YEAR 1					
	12	month	2500.00	30,000	
PERSONNEL TO MAINTAIN SYSTEM - YEAR 2-30					
	12	month	2000.00		$24,000
SAMPLING, ANALYSIS AND DISCHARGE OF EFFLUENT					
Sampling of effluent	20	sample	500.00	10,000	10,000
Sampling of air emissions	50	sample	20.00	1,000	1,000
Field Personnel and Reporting	12	month	100.00	1,200	1,200
Sewer Surcharge	12	month	200.00	2,400	2,400
				$14,600	$14,600
ANNUAL OPERATION AND MAINTENANCE - GROUNDWATER ALTERNATIVE D					
YEAR 1				$128,980	
YEAR 2-30					$101,740
CAPITAL COST (From Table 6-6)					$289,050
TOTAL PRESENT WORTH - GROUNDWATER ALTERNATIVE D					$1,878,986

Assuming 5 Percent Discount Rate for 30 Years;
System Operation for 30 Years

TABLES\ALBANY\6-7

Figures



LEGEND

- ● RESIDUUM WELL
- ○ UPPER OCALA LIMESTONE WELL
- ⊠ LOWER OCALA LIMESTONE WELL
- ⊕ PROPOSED NEW MONITORING WELL LOCATION
- * PROPOSED GROUNDWATER SAMPLING LOCATION

N

0 200 400 800

SCALE FEET

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CLIENT: BRIDGESTONE/FIRESTONE, INC.

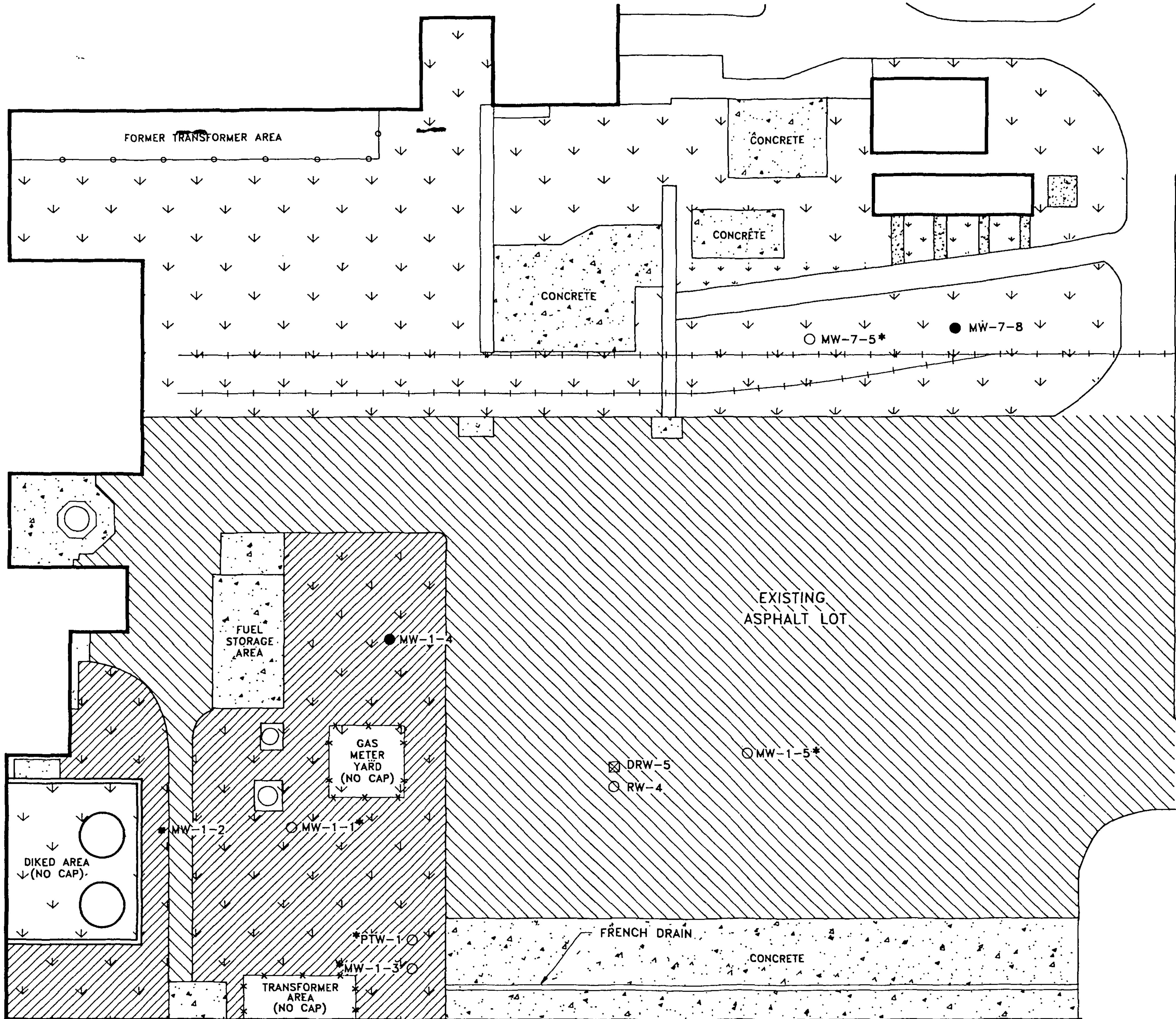
LOCATION: FORMER FIRESTONE FACILITY – ALBANY, GEORGIA

TITLE:

PROPOSED GROUNDWATER SAMPLING LOCATIONS

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
B.Mc	REM	90C6116	7-30-92	6-1

6116-61



LEGEND

- ● EXISTING RESIDUUM WELL
- ○ EXISTING UPPER OCALA LIMESTONE WELL
- ⊠ EXISTING LOWER OCALA LIMESTONE WELL
- * INDICATES EXISTING WELL SCREEN/SAND PACK STRADDLES BOTH RESIDUUM AND UPPER OCALA LIMESTONE (TRANSITION ZONE)
- ▨ PROPOSED ASPHALT CAP OVER NON-PAVEMENT AREAS (SEE FIGURE 6-3)

N

0 25 50 100

SCALE FEET

Woodward-Clyde Consultants

Engineering & sciences applied to the earth & its environment

CLIENT: BRIDGESTONE/FIRESTONE, INC.

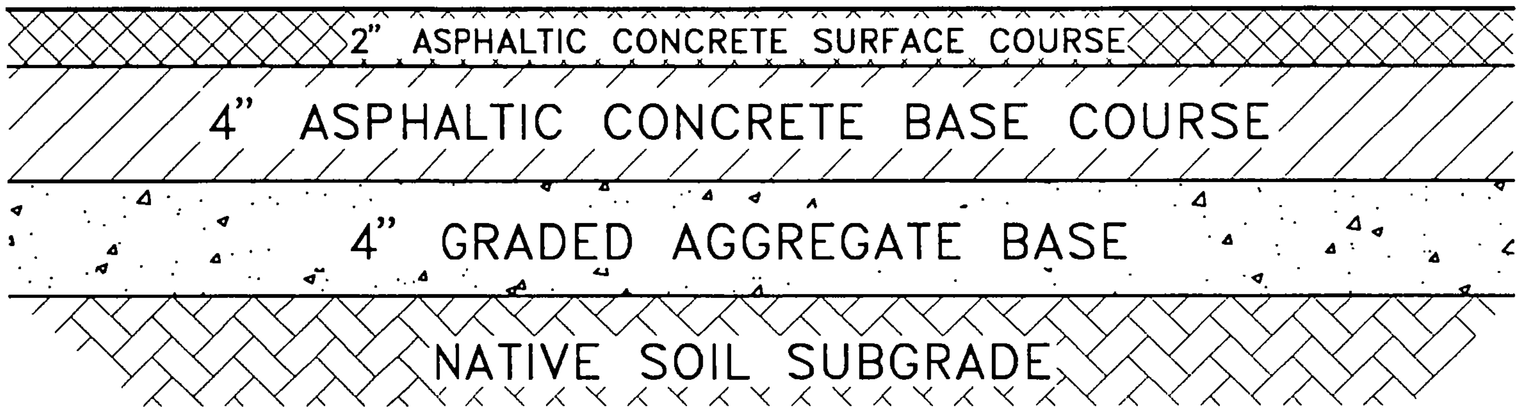
LOCATION: FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

TITLE:

PROPOSED CAPPING AREA - ALTERNATIVE C

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
B.Mc	REM	90C6116	7-31-92	6-2

8116-628



CROSS-SECTION OF ASPHALTIC CONCRETE CAP

FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

DRAWN BY: B.Mc	CHECKED BY: MJM	PROJECT NUMBER: 90C6116	DATE: 10-15-92	FIGURE NO: 6-3

6116-63

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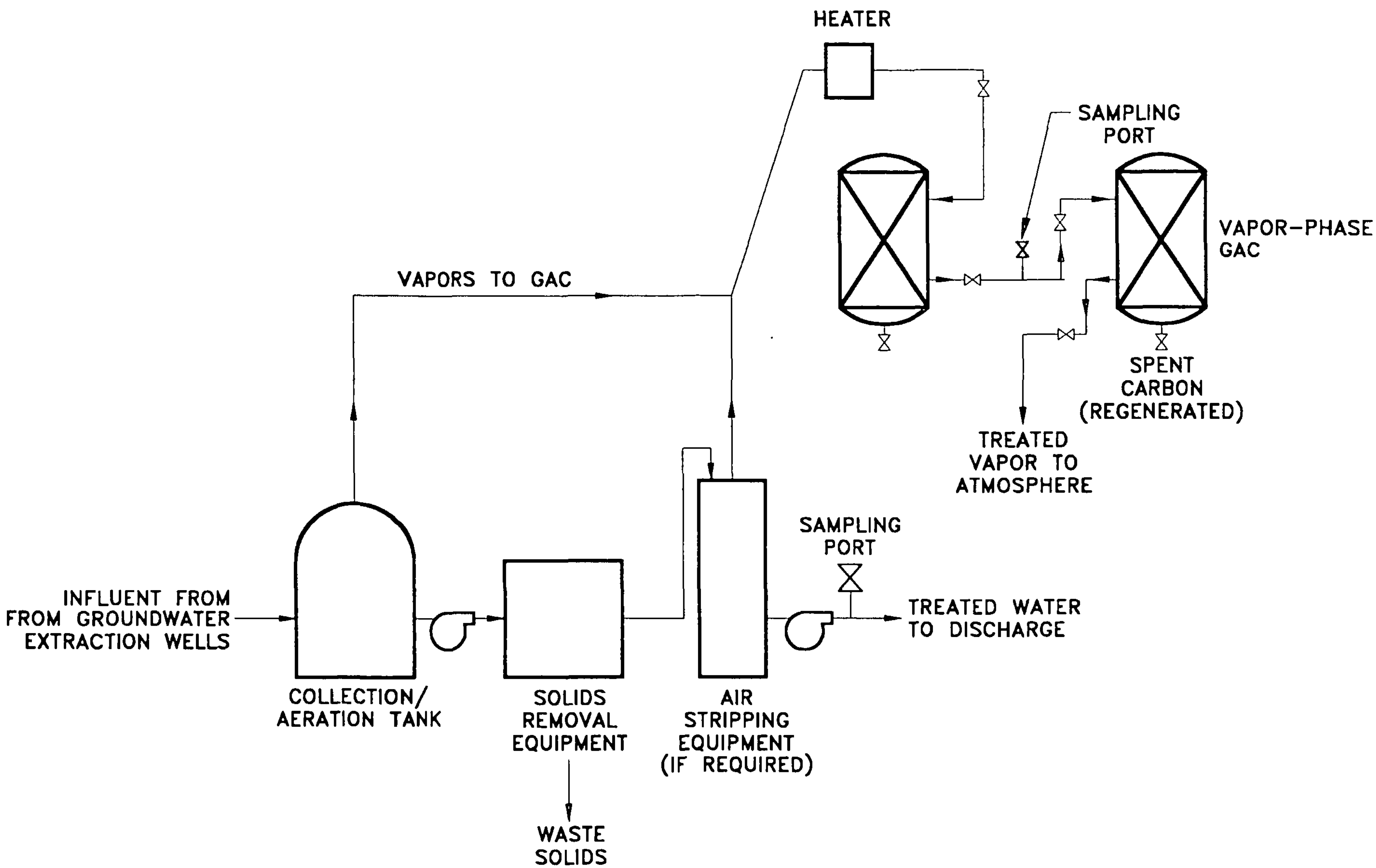

CONCEPTUAL PROCESS FLOW DIAGRAM - ALTERNATIVE D

FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

DRAWN BY: B.Mc	CHECKED BY: REM	PROJECT NUMBER: 90C6116	DATE: 7-31-92	FIGURE NO: 6-4

6116-64A

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7.0
DETAILED DESCRIPTION AND EVALUATION OF SOIL ALTERNATIVES

In this section, the soil alternatives that were screened and retained in Section 5.0 are described and evaluated in further detail. The alternatives are evaluated for the same purposes and against the same evaluation criteria as delineated in Section 6.0 for the Groundwater Alternatives.

7.1 SOIL ALTERNATIVE A: NO ACTION

The no action alternative would involve no remedial actions, and the site would remain in its present condition. This alternative, required by the NCP and CERCLA, is a baseline alternative against which the effectiveness of other alternatives can be compared.

7.1.1 Overall Protection of Human Health and the Environment

The potential for ingestion of or direct dermal contact with contaminants would remain the same as those calculated in the baseline risk assessment.

7.1.2 Compliance with ARARs

Although the PCB Spill Policy under TSCA is not an ARAR, it is a TBC. Soil Alternative A would not address the 10 mg/kg cleanup level in the PCB Spill Policy for nonrestricted access areas. Compliance with action-specific ARARs would not be required because no remedial actions would be performed. There are no location-specific ARARs associated with this alternative.

7.1.3 Long-Term Effectiveness and Permanence

The residual risks to human health and the environment associated with Soil Alternative A would be the same as current risks. An evaluation of the adequacy and reliability of controls is not applicable to this alternative because no controls would be implemented.

7.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

No remedial activities would be conducted. There would be no reduction in the toxicity, mobility, or volume of contaminants except through natural fate and transport processes.

7.1.5 Short-Term Effectiveness

There would be no increase in short-term risk to workers or the community associated with this alternative because no remedial actions would be conducted. Potential adverse environmental effects resulting from construction or implementation would not be encountered because there would be no activities performed at the site.

7.1.6 Implementability

This criterion is not applicable in regard to activities conducted because no remedial activities would occur. Services and materials and the activities normally needed to coordinate with other agencies would not be necessary.

7.1.7 Cost

There would be no capital or O&M costs associated with this alternative because no remedial actions would be conducted.

7.2 SOIL ALTERNATIVE C: INSTITUTIONAL CONTROLS AND CONTAINMENT

Alternative C includes institutional controls and containment of the contamination. Considering the maximum existing PCB concentration of 230 mg/kg (ppm), the institutional controls would be implemented in general accordance with the access and long-term management controls recommended by the U.S. EPA (1990b) for PCB concentrations ranging from 100 to 500 ppm. The institutional controls would include a security fence and deed restrictions to restrict present and future use of the contaminated area. One groundwater monitoring well would be installed and annual groundwater monitoring would be conducted as part of the alternative to evaluate the migration of PCBs into the groundwater. Containment would be provided through the placement of an asphalt cap over the former transformer area shown in Figure 7-1.

Soil samples will be collected from 10 locations in the vicinity of former OT-1 transformer area to further define the extent of contamination prior to capping. Proposed sample locations and depths are shown in Figure 7-2. The samples will be analyzed for PCBs as required to define the horizontal and vertical extent of soil with PCBs exceeding the 10 mg/kg action level. Additional samples will be collected and analyzed if the initially proposed sampling activities do not adequately define the contaminated area.

The area of contamination is anticipated to be relatively small; therefore, site preparation for the construction of the cap could be accomplished in a short period of time. Site preparation would consist of clearing any vegetation in the area and regrading the area to a consistent grade. Construction of the cap will be in accordance with the design outlined for capping over existing grassy areas in the courtyard under Groundwater Alternative C. A cross-section of the proposed cap is shown on Figure 6-3.

A security fence will be constructed around the capped area to prevent any pedestrian and vehicle traffic over the cap. This fence would be a minimum of 6 ft high on all sides of the cap, unless the cap extends to the wall of the facility building. Appropriate warning signs and placards would be placed on the fence to warn against unauthorized entry.

Bi-annual inspections would be performed to ensure effectiveness and provide maintenance for the cap. Appropriate repairs would be made by a qualified contractor, as necessary. The integrity of the security fence will also be monitored.

A monitoring well will be installed adjacent to the capped area to evaluate the effectiveness of the cap and the potential migration of contaminants into the groundwater. The well would be constructed of 2-in. diameter PVC terminating in a 10-ft section of slotted (0.010-in.) well screen. The well would be completed in the first water-bearing zone encountered. Groundwater samples will be collected on an annual basis and analyzed for PCBs. If PCBs are detected in the groundwater at a concentration that equals the current MCL (0.5 $\mu g/l$) an expanded monitoring program would be implemented. The information obtained from the expanded program would be used to evaluate the need for groundwater remediation.

7.2.1 Overall Protection of Human Health and the Environment

Alternative C would protect human health by reducing the risks associated with the area of contamination. The deed restrictions, security fence, and cap would reduce the risk of receptors coming into contact with the contaminated area. The cap would prevent migration of contamination off site due to wind or surface erosion. Soil Alternative C would also protect the environment by reducing the amount of water percolating through the area of contamination, which would reduce leaching. The asphalt cap would contain rather than treat or destroy the contamination; therefore, some long-term residual risk may be associated with the site. A properly designed, constructed, and maintained cap would reduce this long-term residual risk.

7.2.2 Compliance with ARARs

Although the PCB Spill Policy (40 CFR 761.120-139) is not an ARAR, it is a TBC. The 10 mg/kg action level being used in this alternative is consistent with the specified cleanup levels for nonrestricted access areas. Soil Alternative C would comply with the following chemical-specific and action-specific ARARs.

- Toxic Substances Control Act (TSCA): Authorizes U.S.EPA to establish regulations to control specific chemical substances or mixtures that pose an imminent hazard. Contaminants of concern (PCBs) for the site are covered under TSCA.

- Occupational Safety and Health Act (OSHA): These regulations are considered ARARs, specifically 20 USC Section 651-678 that applies to worker health and safety.

There are no location-specific ARARs associated with this alternative.

7.2.3 Long-Term Effectiveness and Permanence

There would be some long-term residual risk associated with this alternative because contamination would remain in place and not be treated. The risk of contaminant migration will be reduced because the asphalt cap would reduce surface water infiltration. The cap, security fence, and deed restrictions would reduce the risk of contact with contaminants.

Long-term maintenance would include periodic inspection of the cap and fence and any required repairs. The long-term reliability of the asphalt cap would be adequate if it is properly designed, constructed, and maintained. Failure of the cover has a low probability of occurrence with proper quality control during construction and regular maintenance.

Groundwater sampling and analysis in the vicinity of the cap would be an effective long-term measure to monitor the effectiveness of the cap and migration of contaminants into the groundwater.

7.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

No treatment would be conducted to actively reduce toxicity or volume of the contaminants. The cap and associated drainage controls would reduce the mobility of the contaminants by reducing wind and surface water erosion and surface water infiltration into the contaminated area. The cap would reduce the potential for future contamination of groundwater by reducing infiltration into the contaminated area, thereby reducing any percolation through the contamination and into the underlying groundwater.

7.2.5 Short-Term Effectiveness

Risk to the community and the environment during the implementation of Soil Alternative C would be relatively low. Workers might be exposed to contaminants during various activities, such as soil sampling and installation of the monitoring well, but this risk would be reduced by the wearing of protective clothing and compliance with

OSHA regulations. Health and safety plans would be developed before starting remedial activities. On-site briefings would be held to provide workers with information concerning safety. Access to the work area by unauthorized personnel would be restricted. Decontamination of drilling and sampling equipment would be conducted to the reduce the possibility of contaminants being carried off the site. No adverse environmental effects associated with this alternative are expected.

The time to complete this alternative, excluding the maintenance and long-term monitoring is expected to be approximately 13 months. This time is estimated as follows:

10 months:	Sampling, analysis and engineering design
3 months:	Site preparation, grading, and construction
12 months:	Deed restriction approval by local courts (concurrent with other activities)

7.2.6 Implementability

Asphalt caps have been used at many sites to contain soil contamination and are a proven and reliable technology. The construction of the cap and fence would be performed using conventional methods and should not present any special difficulties. Contractors to perform the work would be readily available. Materials for the cap would be available from various vendors, including local suppliers. No technical problems have been identified with construction that might lead to schedule delays. The effectiveness of the cap would be monitored through groundwater sampling and analysis in the vicinity of the cap.

It is expected that the cap would be compatible with any groundwater remediation that might be proposed. However, if wells were required in the cap area, watertight connections between the membrane and the well casings would be required. Any future activities involving the excavation of the contaminated area would breach the cap, which would affect the cap's effectiveness in reducing surface water infiltration.

Deed restrictions on this portion of the courtyard area may interfere with future expansion plans of the facility. Any restrictions to property use in this area may impact the future of the tenant.

7.2.7 Cost

The detailed cost estimate of the capital costs for Soil Alternative C is presented in Table 7-1. Capital costs include the construction costs for each major component of the alternative and obtaining deed restrictions. The detailed cost summaries for the O&M costs and the total present worth of this alternative (based on the assumptions outlined in Table 6-1) can be found in Table 7-2.

The capital costs include both direct and indirect costs. The direct costs include preparation of the site and construction of the cap. The capital costs are estimated to be $73,181 for Alternative C. The O&M costs associated with implementing these alternatives include cap maintenance and repair and yearly groundwater sampling and analysis. The costs are estimated to be $3,255 annually and are projected for 30 years. The total present worth of Soil Alternative C is estimated to be $123,218.

7.3 SOIL ALTERNATIVE D: EXCAVATION AND OFF-SITE DISPOSAL

Soil Alternative D would involve mechanical excavation of the area of contamination and disposal at an off-site facility. Excavation would be accomplished by using conventional earth-moving equipment. The volume of contaminated soil to be excavated is currently estimated to be approximately 20 cu yd (30 tons), as described in Section 3.0. To further define the extent of contamination prior to excavation, samples will be collected and analyzed in the same manner as described in Section 7.2 for Soil Alternative C. One sample from within the area be to excavated will also be collected and analyzed for any parameters in addition to PCBs that may be required for off-site disposal.

The soil excavation activities will commence after disposal approval has been obtained, and the extent of PCB contamination has been adequately defined. Upon excavation, the contaminated soil will be placed into lined roll-off containers or dump trucks and transported off-site for disposal. Based on the current maximum PCB concentration of 230 mg/kg, it is anticipated that the excavated soil will be disposed of at a TSCA regulated landfill such as the Chemical Waste Management (CWM) facility in Emelle, Alabama. Following completion of the excavation activities, the excavated area will be backfilled and graded using clean sand or gravel.

7.3.1 Overall Protection of Human Health and the Environment

Soil Alternative D would protect human health by reducing the risks associated with the contaminants. The excavation would reduce the risk of receptors coming into contact with the contamination. Removal of the contamination would eliminate the possibility of water percolating through the contaminants, which would eliminate leaching. The excavation would remove the PCB contamination that exceeds 10 mg/kg and long-term residual risk associated with the site would be reduced.

7.3.2 Compliance with ARARs.

Although the PCB Spill Policy (40 CFR 761.120-139) is not an ARAR, it is a TBC as defined in the RI/FS Guidance Document. The 10 mg/kg action level being used in this alternative is consistent with the cleanup levels specified for nonrestricted access areas. Soil Alternative D would comply with the chemical and action-specific ARARs.

- Toxic Substances Control Act (TSCA): Authorizes U.S.EPA to establish regulations to control specific chemical substances or mixtures that pose an imminent hazard. PCBs are covered under TSCA. Soils contaminated with more than 50 mg/kg PCBs may be disposed of at TSCA incinerator, TSCA chemical waste landfill, or TSCA approved alternative disposal method (40 CFR 761.60(a)(4)). PCBs at concentrations of 50 mg/kg or more must be disposed of within one year after being placed in storage. PCBs at concentrations greater than 50 mg/kg currently exist on the site.

- U.S. Department of Transportation Hazardous Materials Regulations: Regulations for the transport of hazardous materials. These regulations include general requirements, shipping papers, marking and labeling, general shipping requirements, and shipping requirements via motor carriers. These regulations will come into effect if the contaminants of concern need to be transported off-site.

- Occupational Safety and Health Act (OSHA): These regulations are considered ARARs, specifically 20 USC Section 651-678 that applies to worker health and safety.

There are no location-specific ARARs associated with this alternative.

7.3.3 Long-Term Effectiveness and Permanence

Long-term risks at the site would be reduced because the soil with PCB concentrations exceeding 10 mg/kg would be excavated and removed from site. The excavated soil would present a long-term residual risk since it would be disposed of in an off-site landfill. Mechanical excavation is a reliable technology that can adequately accomplish the soil removal. No delays are anticipated in placement of the contaminants in a controlled landfill due to the relatively small volume of soil to be removed and the concentrations of PCBs that have been identified in the soil.

7.3.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Removal of the soil having PCB concentrations of greater than 10 mg/kg would effectively reduce the toxicity, mobility, and volume of the on-site PCBs. The mobility of the PCBs would be indirectly reduced by placing the contaminated soil in a controlled landfill.

7.3.5 Short-Term Effectiveness

Risk to the community and the environment during the implementation of Soil Alternative D would be relatively low. Workers might be exposed to contaminants during sampling and excavation activities, but the potential for exposure would be reduced by the wearing of protective clothing and compliance with OSHA requirements. A decontamination station would be set up near the sampling and excavation areas for equipment and personnel ensuring that PCBs would not be transported off-site in an uncontrolled manner. Health and safety plans would be developed before starting remedial activities. On-site briefings would be held to provide workers with information concerning safety. Access to the work area by unauthorized personnel would be restricted.

Potential adverse environmental effects associated with this alternative would include noise pollution from the sampling and excavation equipment and transport vehicles. Wearing of hearing protection by workers or personnel exposed to noise would reduce potential adverse effects associated with this alternative.

The time to complete this alternative is expected to be approximately 13 months. This time was estimated as follows:

12 months: Sampling, analysis, and landfill acceptance.
1 month: Excavation, off-site transportation, disposal, and backfilling.

7.3.6 Implementability

The excavation would be performed using conventional methods and should not present any special difficulties. Contractors to perform the work would be readily available. Excavation equipment would be available from various vendors, including local suppliers. No technical problems have been identified with excavation and disposal that might lead to schedule delays. Permits for off-site disposal would be coordinated prior to beginning excavation.

7.3.7 Cost

The detailed cost estimate of the capital costs for Soil Alternative D is presented in Table 7-3. Capital costs include verification sampling, excavation, transportation and disposal and are estimated to be $56,233. There are no O&M costs associated with this alternative.

7.4 SOIL ALTERNATIVE E: EXCAVATION, SOLVENT EXTRACTION, AND ON/OFF-SITE DISPOSAL

Soil Alternative E would involve mechanical excavation, on-site treatment by means of solvent extraction, and on-site disposal of soil. Excavation would be accomplished using conventional earth-moving equipment. Following excavation, the soil would be loaded into a hopper and then to the solvent extraction vessel for treatment. The treatment utilizes a solvent such as triethylamine (TEA) to extract contaminants from soil. The initial stage of the process is performed at low temperatures so that the extract solution contains most of the water from the soil. The extract can be separated from the water at higher temperatures, resulting in a solvent/oil phase and a water phase. These two phases can be separated by gravity and decanted. Later extraction stages are performed at the higher temperatures to enhance the removal of contaminants from the soils. The solvent can be recovered and recycled for use in later extractions. Residual solvent can be removed from the treated soil by indirect heating. Any remaining TEA in the soil would completely biodegrade in a very short period of time. The heating also serves to dry the soil. The entire solvent extraction may be performed in a self-contained unit to avoid excess handling of the soil.

The solvent extraction process is expected to result in two types of liquid waste products. The first would be the water phase, which is anticipated to be suitable for disposal at a nonhazardous wastewater treatment facility. Approximately 120 to 130 gal of water-phase product is created per cu yd of soil treated. The second type of waste is the oil-phase product which contains the extracted contaminants. Approximately 2 gal of oil-phase product would be produced per cu yd of soil treated. The oil-phase product would be containerized and shipped off site for disposal at a permitted incineration facility.

It is anticipated that the solvent extraction process will be able to reduce the PCB concentration in the excavated soil to less than 2 mg/kg. This concentration would meet the requirements for on-site disposal of the treated soil into the excavated area with no long-term management controls. A multi-phase extraction may be required to reduce the PCB concentrations to less than 2 mg/kg. Treatability testing would be required to determine the design parameters for the solvent extraction process. If the treatability testing indicates that the PCB concentrations can not be reduced to less than 2 mg/kg using solvent extraction, the alternative would have to be modified to include an alternate treatment method or off-site landfilling. In addition, if testing of the treated soil indicates PCB concentrations that exceed 2 mg/kg, additional treatment or off-site landfilling would be required.

The volume of contaminated soil to be excavated and treated is currently estimated to be approximately 20 cu yd (30 tons), as described in Section 7.2. However, to further define the extent of contamination prior to excavation, samples will be collected and analyzed in the same manner as described for Soil Alternative C.

7.4.1 Overall Protection of Human Health and the Environment

Soil Alternative E would protect human health and the environment by reducing the risks associated with the contaminants. The excavation of soil would reduce the risk of receptors coming into contact with the contamination. The solvent extraction process would extract the contaminants from the soil. Removal of the contamination would eliminate the possibility of water percolating through the contaminants, which would eliminate leaching. Because the excavation would remove the PCB contamination that exceeds 10 mg/kg, long-term residual risk associated with the site would be minimized. The solvent extraction would remove the PCBs from the soil, thereby reducing the risk of recontamination of the site following on-site placement of the soil.

7.4.2 Compliance with ARARs.

Although the PCB Spill Policy (40 CFR 761.120-139) is not an ARAR, it is a TBC. The 10 mg/kg action level being used in this alternative is consistent with the specified cleanup levels for nonrestricted access areas. Soil Alternative E would comply with the following chemical-specific and action-specific ARARs.

- <u>Toxic Substances Control Act (TSCA):</u> Authorizes U.S.EPA to establish regulations to control specific chemical substances or mixtures that pose an imminent hazard. Contaminants of concern (PCBs) for the site are covered under TSCA. Soils contaminated with more than 50 mg/kg PCBs may be disposed of at a TSCA incinerator, TSCA chemical waste landfill or TSCA-approved alternative disposal method (40 CFR 761.60(a)(4)). PCBs at concentrations of 50 mg/kg or more must be disposed of within 1 year after being placed in storage. PCBs at concentrations greater than 50 mg/kg currently exist on the site.

- U.S. Department of Transportation Hazardous Materials Regulations: Regulations for the transport of hazardous materials include general requirements, shipping papers, marking and labeling, general shipping requirements, and shipping requirements via motor carriers. These regulations will come into effect if the contaminants of concern need to be transported off-site.

- Occupational Safety and Health Act (OSHA): These regulations are considered ARARs, specifically 20 USC Section 651-678 that applies to worker health and safety.

There are no location-specific ARARs associated with this alternative.

7.4.3 Long-Term Effectiveness and Permanence

Because the soil with PCB concentrations exceeding 10 mg/kg would be excavated and treated to remove PCBs before being replaced on site, long-term risk associated with this alternative would be minimized. The treated soil would not be expected to present a long-term residual risk because contaminants would be removed prior to on-site placement. Recovered oil-phase product would not present a long-term residual risk since it would be incinerated. The water-phase product is expected to be suitable for disposal as nonhazardous wastewater. Mechanical excavation is a reliable technology that can adequately accomplish the removal of contaminants. The U.S. EPA (1990b) has stated that treatability tests run to date have indicated that there is probably a limit to the percentage reduction (on the order of 99.5%) achievable with solvent extraction. Repeat applications can increase the reductions obtained, and studies have shown that PCB concentrations of less than 2 mg/kg in the treated soil can be achieved.

7.4.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Excavation would directly reduce the mobility of the contaminants by removing the source and reducing the potential for future contamination of the groundwater. The toxicity of the contaminants would be reduced by the solvent extraction process. Incineration of the recovered oil-phase product containing the PCBs will destroy the contaminants, and therefore would reduce the volume and toxicity of the PCBs.

7.4.5 Short-Term Effectiveness

Risk to the community and the environment during the implementation of Soil Alternative E would be relatively low. Workers might be exposed to contaminants during sampling, excavation, and the solvent extraction process, but this would be minimized by the wearing of protective clothing and compliance with OSHA requirements. A decontamination station would be set up near the sampling, excavation, and treatment areas for equipment and personnel to prevent PCBs from being transported off site in an uncontrolled manner. Health and safety plans would be developed before starting remedial activities. On-site briefings would be held before the work began and repeated periodically to provide workers with information concerning safety. Access to the work areas by unauthorized personnel would be restricted.

Potential adverse environmental effects associated with this alternative would include noise pollution from the excavation and treatment equipment and transport vehicles. Wearing of hearing protection by workers or personnel exposed to noise would reduce potential adverse effects associated with this alternative.

The time to achieve the remedial action objectives is expected to be approximately 2 years. This time was estimated as follows:

18 months:	Sampling, analysis, treatability testing, and permitting
3 months:	Site excavation, solvent extraction, and on-site disposal
3 months:	Waste characterization and off-site disposal

7.4.6 Implementability

Implementation of this on-site treatment alternative would be very difficult due to the small volume of soil that is anticipated to require treatment. Permits for on-site treatment are likely to be difficult to obtain.

7.4.7 Cost

The detailed cost estimate of the capital costs for Soil Alternative E is presented in Table 7-4. Capital costs include verification sampling, treatability testing, excavation, solvent extraction, and on-site placement of treated soil and are estimated to be $214,836. There are no O&M costs associated with this alternative.

Tables

TABLE 7-1
SOIL ALTERNATIVE C
INSTITUTIONAL CONTROLS AND ASPHALT CAPPING
CAPITAL COST ESTIMATE

REMEDIAL ACTIVITY	QUANTITY	UNIT	UNIT COST	TOTAL COST
VERIFICATION SAMPLING				
PCB Soil Sampling (Method 8080) includes duplicate samples	20	sample	85.00	1,700
Field Equipment	1	ls	1000.00	1,000
Field Personnel & Reporting	1	ls	6000.00	6,000
				$8,700
INSTITUTIONAL CONTROLS				
Groundwater Monitoring Well	1	each	6000.00	6,000
Fencing	170	linear ft.	20.00	3,400
				$9,400
CAP CONSTRUCTION				
Site Prep	1	ls	2500.00	2,500
Materials	1	ls	9000.00	9,000
Drainage Controls	1	ls	2500.00	2,500
				$14,000
DIRECT COST SUBTOTAL				$32,100
SCOPE CONTINGENCIES				8,025
ENGINEERING DESIGN				6,420
CONSTRUCTION TOTAL				$46,545
PERMITTING AND LEGAL				4,655
CONSTRUCTION SERVICES				6,982
TOTAL IMPLEMENTATION COST				$58,181
DEED RESTRICTIONS				$15,000
TOTAL CAPITAL COST				$73,181

TABLE 7-2
SOIL ALTERNATIVE C
INSTITUTIONAL CONTROLS AND ASPHALT CAPPING
OPERATION AND MAINTENANCE COST/TOTAL PRESENT WORTH ESTIMATE

REMEDIAL ACTIVITY	QUANTITY	UNIT	UNIT COST	ANNUAL COST YEAR 1	ANNUAL COST YEAR 2-30
GROUNDWATER MONITORING - YEAR 1-30					
Annual sampling of 1 well for PCBs (Method 8080), plus duplicate and field blank	3	sample	85.00	255	255
Field Personnel and Reporting	1	event	2000.00	2,000	2,000
				$2,255	$2,255
CAP MAINTENANCE - YEAR 1-30					
Inspection and Maintenance	1	ls/year	700.00	700	700
Cover Maintenance	1	ls/year	300.00	300	300
				$1,000	$1,000
ANNUAL OPERATION AND MAINTENANCE - SOIL ALTERNATIVE C					
YEAR 1				$3,255	
YEAR 2-30					$3,255
CAPITAL COST (From Table 7-1)					$73,181
TOTAL PRESENT WORTH - SOIL ALTERNATIVE C					**$123,218**

Assuming 5 Percent Discount Rate for 30 Years;
Groundwater Monitoring for 30 Years

TABLE 7-3
SOIL ALTERNATIVE D
EXCAVATION AND OFF-SITE DISPOSAL
COST ESTIMATE

REMEDIAL ACTIVITY	QUANTITY	UNIT	UNIT COST	TOTAL COST
VERIFICATION SAMPLING				
PCB Soil Sampling (Method 8080) includes duplicate samples	20	sample	85.00	1,700
Field Equipment	1	ls	1000.00	1,000
Field Personnel & Reporting	1	ls	6000.00	6,000
				$8,700
EXCAVATION				
Labor	2	ls	775.00	1,550
Equipment	1	backhoe	450.00	450
Backfilling	30	ton	12.50	375
				$2,375
TRANSPORTATION				
Roll-Off Container Drop & Setup Fee	2	each	1550.00	3,100
Rental	1	week	450.00	450
Transportation (400 mi.)	2	each	1200.00	2,400
				$5,950
DISPOSAL				
Waste Characterization	1	sample	2000.00	2,000
Disposal	30	ton	400.00	12,000
				$14,000
DIRECT COST SUBTOTAL				$31,025
SCOPE CONTINGENCIES				7,756
ENGINEERING DESIGN				6,205
CONSTRUCTION TOTAL				$44,986
PERMITTING AND LEGAL				4,499
CONSTRUCTION SERVICES				6,748
TOTAL IMPLEMENTATION COST				$56,233
TOTAL CAPITAL COST				$56,233
ANNUAL OPERATION & MAINTENANCE				$0
TOTAL PRESENT WORTH - SOIL ALTERNATIVE D				$56,233

TABLE 7-4
SOIL ALTERNATIVE E
EXCAVATION, SOLVENT EXTRACTION, ON/OFF-SITE DISPOSAL
COST ESTIMATE

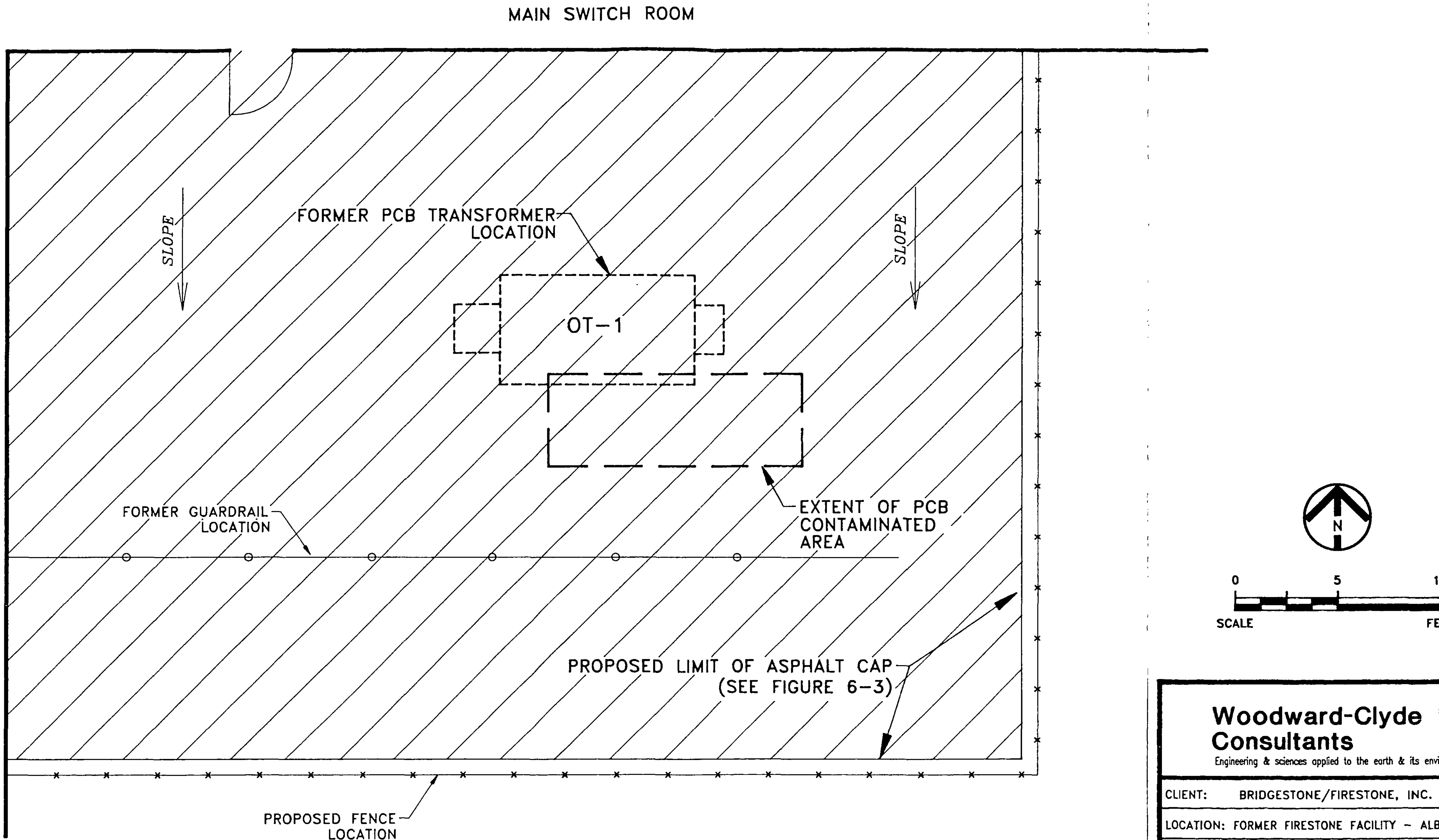
REMEDIAL ACTIVITY	QUANTITY	UNIT	UNIT COST	TOTAL COST
VERIFICATION SAMPLING				
PCB Soil Sampling (Method 8080) (including duplicate samples)	20	sample	85.00	1,700
Field Equipment	1	ls	1000.00	1,000
Field Personnel & Reporting	1	ls	6000.00	6,000
				$8,700
TREATABILITY TESTING	1	ls	30000.00	$30,000
EXCAVATION				
Labor	2	each	775.00	1,550
Equipment	1	backhoe	450.00	450
				$2,000
SOLVENT EXTRACTION				
Mobilization/Demobilization	1	ls	50000.00	50,000
Solvent Extraction	30	ton	500.00	15,000
				$65,000
LIQUID WASTE TRANSPORTATION AND DISPOSAL				
Waste Characterization	2	sample	2000.00	4,000
Transportation – oil-phase product	1	each	500.00	500
Disposal of oil-phase product	40	gal	2.00	80
Disposal of water-phase product	2500	gal	0.50	1,250
				$5,830

TABLE 7-4
SOIL ALTERNATIVE E
EXCAVATION, SOLVENT EXTRACTION, ON/OFF-SITE DISPOSAL
COST ESTIMATE

REMEDIAL ACTIVITY	QUANTITY	UNIT	UNIT COST	TOTAL COST
TREATED SOIL STORAGE				
Roll-off Container Drop and Setup Fee	2	each	1550.00	3,100
Rental	1	week	450.00	450
Pickup	2	each	500.00	1,000
				$4,550
ON-SITE PLACEMENT OF TREATED SOIL				
Labor	2	each	775.00	1,550
Equipment	1	backhoe	450.00	450
	1	front-end loader	450.00	450
				$2,450
CONSTRUCTION SUBTOTAL				$118,530
SCOPE CONTINGENCIES				29,633
ENGINEERING DESIGN				23,706
CONSTRUCTION TOTAL				$171,869
PERMITTING AND LEGAL				17,187
CONSTRUCTION SERVICES				25,780
TOTAL IMPLEMENTATION COST				$214,836
TOTAL CAPITAL COST				$214,836
ANNUAL OPERATION & MAINTENANCE				$0
TOTAL PRESENT WORTH - SOIL ALTERNATIVE E				$214,836

TABLES\ALBANY\7-4

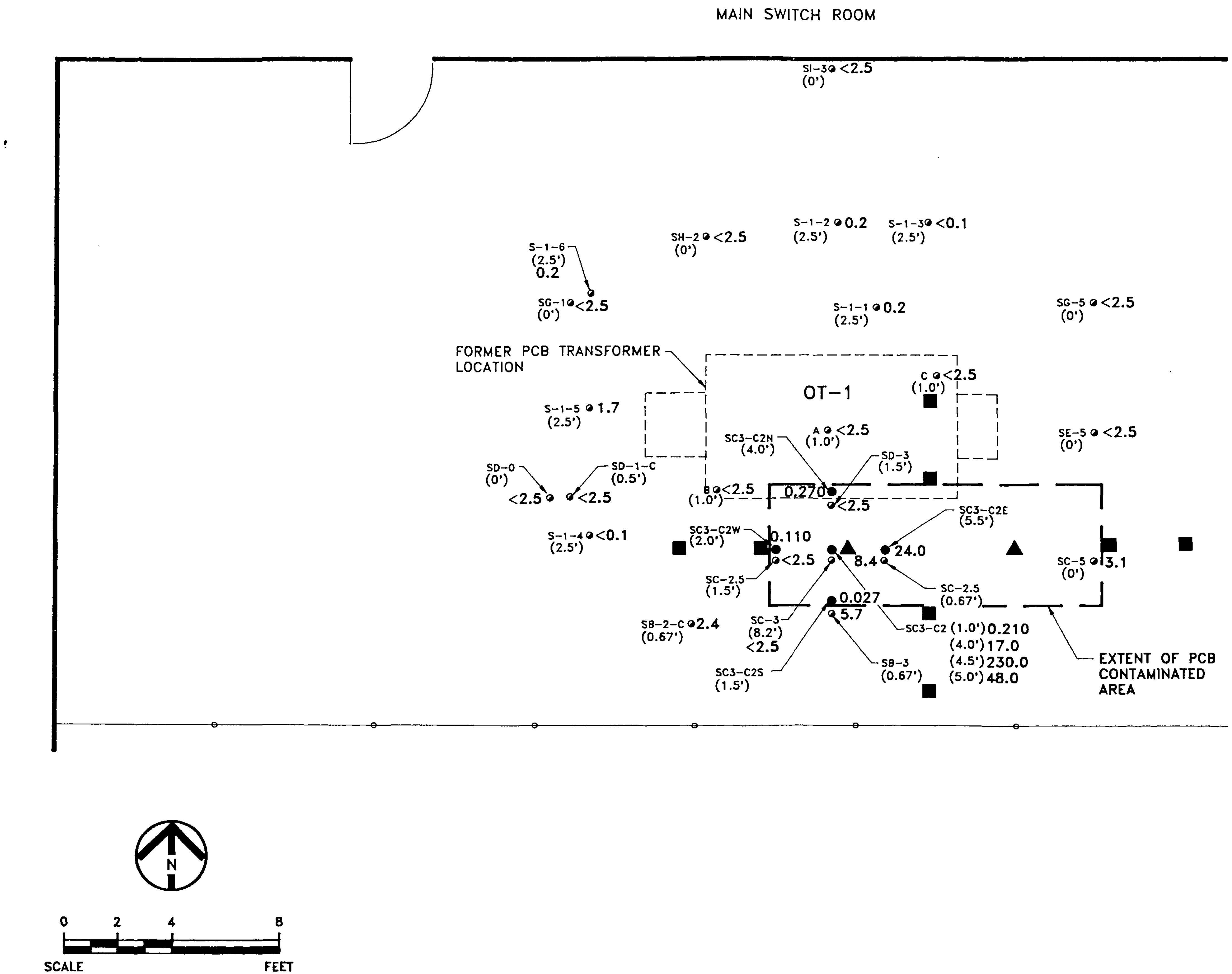
Figures



Woodward-Clyde Consultants
Engineering & sciences applied to the earth & its environment

CLIENT:	BRIDGESTONE/FIRESTONE, INC.
LOCATION:	FORMER FIRESTONE FACILITY – ALBANY, GEORGIA
TITLE:	**PROPOSED ASPHALT CAP LOCATION - FORMER OT-1 TRANSFORMER AREA**

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
B.Mc	MJM	90C6116	10-15-92	7-1



LEGEND

- PRE RI SOIL SAMPLE LOCATION
- RI CONFIRMATORY SOIL SAMPLE LOCATION

<2.5 PCB CONCENTRATION REPORTED IN *mg/kg (ppm)*

(0.5') DEPTH OF SAMPLE IN FEET

▲ PROPOSED BOTTOM SOIL SAMPLE LOCATION (SAMPLE DEPTH OF 6, 7, 8, 9 AND 10 FT.)

■ PROPOSED PERIMETER SOIL SAMPLE LOCATION (SAMPLE DEPTH OF 4 FT.)

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CLIENT: BRIDGESTONE/FIRESTONE, INC.

LOCATION: FORMER FIRESTONE FACILITY – ALBANY, GEORGIA

TITLE: **PROPOSED SOIL SAMPLING LOCATIONS - FORMER OT-1 TRANSFORMER AREA**

DRAWN BY:	CHECKED BY:	PROJECT NO:	DATE:	FIGURE NO:
B.Mc	MJM	90C6116	7-14-92	7-2

6116-72

8.0 COMPARATIVE ANALYSIS OF REMEDIAL ACTION ALTERNATIVES

The following sections compare the groundwater and soil remedial alternatives on the basis of the evaluation criteria developed and discussed throughout the Feasibility Study. These criteria include protection of human health and the environment; compliance with ARARs; long-term effectiveness and permanence; reduction in toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost.

8.1 COMPARATIVE ANALYSIS OF GROUNDWATER ALTERNATIVES

In order to facilitate the comparison of groundwater alternatives, the following sections present a summary of the detailed evaluation performed in Section 6.0. The comparison is based on the results of the detailed evaluation for each of the seven criteria required by the NCP. The results of the cost sensitivity analysis is also presented.

8.1.1 Overall Protection of Human Health and the Environment

Groundwater Alternative A would not provide additional protection to human health or the environment from the potential risks posed by the groundwater contamination in the courtyard area within the manufacturing area. Alternatives B and C would provide protection to human health by reducing the potential for contact with or ingestion of groundwater through deed restrictions. In addition, Alternative C would inhibit potential migration of contaminants into the useable aquifer. Groundwater extraction, in Alternative D, would provide additional protection to the environment and human health through extraction and treatment of groundwater.

8.1.2 Compliance with ARARs

Groundwater Alternative A would not provide a mechanism to evaluate compliance with the chemical-specific ARARs. Action-specific ARARs would not be applicable to Alternative A because no remedial actions would be implemented. Alternatives B, C, and D would provide a mechanism to evaluate compliance with chemical-specific

ARARs and would comply with action-specific ARARs. There are no location-specific ARARs applicable to the site.

8.1.3 Long-term Effectiveness and Permanence

Groundwater Alternative A would not provide a mechanism to evaluate the long-term effectiveness and permanence because there is no mechanism, such as groundwater monitoring, to assess potential changes in contaminant concentrations at the boundary of the manufacturing area. Alternative B would provide a mechanism to assess potential changes in contaminant concentrations (groundwater monitoring), and a mechanism for additional protection of human health (deed restrictions). Alternative C would provide this long-term effectiveness and permanence, and would also serve to inhibit potential migration of contaminants through containment. Alternative D would reduce long-term risk through extraction and treatment of groundwater.

8.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

No contaminated groundwater would be treated under Groundwater Alternatives A, B or C. Thus, reduction in toxicity, mobility, or volume would only result through natural processes. Alternative C would result in additional reduction in potential contaminant mobility by inhibiting surface water infiltration. The toxicity, mobility, and volume would be reduced by Alternative D at an accelerated pace.

8.1.5 Short-Term Effectiveness

The remedial goals are not currently exceeded at the boundary of the manufacturing area. No additional risks to the public, environment or site workers would be associated with Alternative A because no remedial actions would be implemented. The risks to the public and the environment associated with Alternatives B, C, and D would be minimal. Risks to site workers would be somewhat higher, but this risk would be reduced by compliance with OSHA regulations.

8.1.6 Implementability

No actions would be taken under Alternative A; therefore, the implementability criterion does not apply to this alternative. The evaluation of Alternatives B, C, and D are the same with respect to the implementability criterion. Each alternative would be easy to implement as the technologies and the materials and services required to implement the alternatives would be readily available. The overall effectiveness of the alternatives would be evaluated through sampling and analysis of the groundwater at the site in addition to monitoring of treated effluent for Alternative D.

8.1.7 Costs

The cost comparison for the groundwater alternatives includes the detailed cost estimates for each alternative and the sensitivity analysis that evaluates the effect of changes on the total present worth of each alternative.

8.1.7.1 Individual Cost Comparison

No capital or O&M costs would be incurred by Alternative A. The capital, O&M, and total present worth costs associated with Alternative B would be lower than for either Alternative C or D. The total present worth of Alternative B is $334,490 and the total present worth of Alternative C is $611,533, while the total present worth of Alternative D is $1,878,986.

8.1.7.2 Cost Sensitivity Analysis

The cost estimates prepared for each groundwater alternative involve approximation, estimation, assumption, and engineering judgement. In most cases, one or two variables have a significant effect on an alternative's present worth. The purpose of the sensitivity analysis is to evaluate the impact of these parameters on the total present worth by varying them while keeping all other factors constant.

The cost sensitivity analysis for the groundwater alternatives evaluates the effect of varying several parameters on the total present worth of the alternatives. The time required for the alternative was doubled and decreased by one-half to determine the effect of time on the present worth of the alternatives. The number of extraction wells required to extract groundwater was increased for the same analysis. The sensitivity analysis also evaluated the effect of varying the discount rate used to calculate the total present worth of each alternative. Discount rates of both 10 and 3 percent were used. Costs are not associated with the no action alternative; therefore, the cost sensitivity analysis is not applicable to Alternative A. The results of the sensitivity analyses are presented in Table 8-1.

Doubling the time required for the alternative to 60 years for Alternatives B, C, and D increases the present worth of the alternatives by 17%, 14% and 19%, respectively. Decreasing the time for each alternative to 15 years results in a decrease in the present worth of the alternatives by 24%, 20%, and 27%, respectively.

Doubling the number of extraction wells required for Alternative D results in an increase in the total present worth by 1%.

The present worth cost indicates the amount of money that would have to be invested at the beginning of the remedial action at a specified interest rate (the discount rate) to pay for all costs incurred throughout the life of the alternative. Decreasing the discount rate of the alternatives to 3% results in an increase of 21% for Alternative B, 17% for Alternative C, and 23% for Alternative D. Increasing the discount rate to 10% decreases the total present worth of Alternative B by 29%, Alternative C by 24%, and Alternative D by 32%.

8.2 COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES

In order to facilitate the comparison of soil alternatives, the following sections present a summary of the detailed evaluation performed in Section 6.0. The comparison is made based on the results of the detailed evaluation for each of the seven criteria required by the NCP. The results of the cost sensitivity analysis is also presented.

8.2.1 Overall Protection of Human Health and the Environment

Soil Alternative A would not provide additional protection to human health or the environment from risks posed by the contaminants in the soil. Alternative C would protect human health by reducing the potential for direct contact with contaminants and reducing the migration of contaminants through capping of the PCBs at the source area. The cap would protect the environment by reducing infiltration of water through the contaminants and subsequently reducing the potential for contaminant migration to the groundwater. A long-term residual risk would be associated with Soil Alternative C because the contaminants would be contained by capping rather than destroyed. Soil Alternatives D and E would protect human health and the environment by removing the contaminants from the site. There would be some long-term residual risk associated with Alternative D since contaminants would be disposed of in a off-site landfill. The contaminants would be destroyed by incineration in Alternative E. Alternative A would not meet the remedial action objectives. Each of the remaining alternatives would meet the remedial action objectives.

8.2.2 Compliance with ARARs

No chemical-specific ARARs are available that can be used to establish cleanup level goals for the site soil. Location and action-specific ARARs would not be applicable to Soil Alternative A because no remedial actions would be implemented. Alternatives C, D, and E would comply with all federal and state action and location-specific ARARs.

8.2.3 Long-term Effectiveness and Permanence

Soil Alternative A would continue to be associated with a long-term risk as long as the contaminant concentrations in the soil exceed the cleanup goals. This alternative does not include a mechanism for assessing any changes in contaminant concentrations. Proper maintenance of the cap in Alternative C would ensure its long-term reliability. Groundwater monitoring would provide a mechanism to assess the effectiveness of the cap. Alternatives D and E would have better long-term effectiveness and permanence because the contamination would be removed from the site.

8.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

No contaminated soil would be treated under Soil Alternative A, and no reduction in toxicity, mobility, or volume would result, except through natural processes. Alternative C would not reduce the toxicity or volume, but would reduce the mobility of the contaminants. Although there would be no treatment or reductions in the toxicity or volume of contaminants in Alternative D, the excavation would directly reduce their mobility. The toxicity, mobility, and volume of contaminants would be effectively reduced through the treatment proposed in Alternative E.

8.2.5 Short-Term Effectiveness

No risks to the public, environment or site workers would be associated with Alternative A because no remedial actions would be implemented. The risks to the public and the environment associated with Alternatives C, D, and E would be minimal. Risks to site workers would be somewhat greater, but this risk would be reduced by compliance with OSHA regulations.

8.2.6 Implementability

No actions would be taken under Alternative A; therefore, the implementability criterion does not apply to this alternative. Capping, as specified under Alternative C, is a conventional and widely used method for containing contamination. However, Alternative C may be difficult to implement, as it may affect growth of the facility. Soil Alternative D would be relatively easy to implement, excavation is a widely used and proven method for removing contamination. Alternative E is anticipated to be very difficult to implement due to permitting requirements, the relatively complex nature of on-site treatment, and the small volume of soil to be treated. Treatability testing would be required for Alternative E to determine design parameters for the solvent extraction process.

8.2.7 Costs

The cost comparison for the soil alternatives includes the detailed cost estimates for each alternative and the sensitivity analysis that evaluates the effect of changes on the total present worth of each alternative.

8.2.7.1 Individual Cost Comparison

No capital or O&M costs would be incurred by Alternative A. Alternative C is the only soil alternative that has O&M costs associated with it. The total present worth of Alternative C is $123,218 and the total present worth of Alternative D is $56,233. The cost for implementation of Alternative E is $214,836, which is four times the estimated cost for Alternative D. No O&M costs would be incurred by either Alternative D or E.

8.2.7.2 Cost Sensitivity Analysis

The cost estimates prepared for each soil alternative involve approximation, estimation, assumption, and engineering judgement. In most cases, one or two variables have a significant effect on an alternative's present worth. The purpose of the sensitivity analysis is to evaluate the effect of these parameters on the total present worth by varying them while keeping all other factors constant.

The cost sensitivity analysis for the soil alternatives evaluates the effect of varying several parameters on the total present worth of the alternatives. The time required for the alternative was doubled and decreased by one-half to determine the effect of time on the present worth of the alternatives. The sensitivity analysis also evaluated the effect of varying the discount rate used to calculate the total present worth of each alternative. Discount rates of both 10 and 3 percent were used. The amount of contaminated soil to be excavated/treated was doubled to determine the effect of volume on the present worth of the applicable alternatives. The cost of transport and disposal was also doubled. Because no costs are associated with the no action alternative, the cost sensitivity analysis is not applicable to Alternative A. The results of the sensitivity analysis are presented in Table 8-2.

Doubling the O&M time to 60 years for Alternative C increases the present worth of the alternative by 9%. Decreasing the time for Alternative C to 15 years results in a decrease in the present worth of the alternative by 13%.

The present worth cost indicates the amount of money that would have to be invested at the beginning of the remedial action at specified interest rate (the discount rate) to pay for all costs incurred throughout the life of the alternative. Decreasing the discount rate of the Alternative C to 3% results in an increase of 11%. Increasing the discount rate to 10% decreases the total present worth of Alternative C by 16%.

Doubling the amount of soil to be excavated for Alternative D results in an increase of the present worth by 72%. Doubling the transport and disposal costs result in an increase of the present worth by 64%. Doubling the amount of soil to be treated in Alternative E results in an increase of the present worth by 25%. Doubling the cost of transport and disposal of treatment wastes would result in an increase of the present worth of Alternative E by 5%.

8.3 POTENTIAL COMBINATIONS OF GROUNDWATER AND SOIL ALTERNATIVES

The groundwater and soil alternative can be combined to for the remedial action alternatives for mitigation of this site. The four groundwater alternatives and three soil alternatives form an array of ten potential alternatives. The total present worth of each of the ten alternatives is presented in Table 8-3. Any of the groundwater alternatives are compatible with any of the soil alternatives.

Tables

TABLE 8-1
RESULTS OF COST SENSITIVITY ANALYSIS - GROUNDWATER ALTERNATIVES
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Parameters Affecting Cost Sensitivity	Total Present Worth					
	Groundwater Alternative B		Groundwater Alternative C		Groundwater Alternative D	
	Cost	Percent Change	Cost	Percent Change	Cost	Percent Change
Original Present Worth Estimate	$334,490		$611,533		$1,878,986	
Discount Rate						
3%	$403,453	21%	$714,320	17%	$2,309,646	23%
10%	$237,232	-29%	$466,710	-24%	$1,272,908	-32%
Double Time Required for O&M	$392,253	17%	$697,751	14%	$2,240,859	19%
Reduce Time Required for O&M by 50%	$253,407	-24%	$490,508	-20%	$1,371,019	-27%
Double Number of Extraction Wells	—	—	—	—	$1,904,299	1%

TABLE 8-2
RESULTS OF COST SENSITIVITY ANALYSIS - SOIL ALTERNATIVES
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Parameters Affecting Cost Sensitivity	Soil Alternative C		Soil Alternative D		Soil Alternative E	
	Cost	Percent Change	Cost	Percent Change	Cost	Percent Change
Original Present Worth Estimate	$123,218		$56,233		$214,836	
Discount Rate						
3%	$136,980	11%	NA	NA	NA	NA
10%	$103,886	-16%	NA	NA	NA	NA
Double Time Required for O&M	$134,796	9%	NA	NA	NA	NA
Reduce Time Required for O&M by 50%	$106,967	-13%	NA	NA	NA	NA
Double Amount of Contaminated Soil to be Excavated/Treated	NA	NA	$96,697	72%	$268,903	25%
Double Transport/Disposal Cost	NA	NA	$92,392	64%	$225,403	5%

NA = not applicable to alternative

TABLE 8-3
TOTAL PRESENT WORTH OF SITE-WIDE ALTERNATIVES
FORMER FIRESTONE FACILITY - ALBANY, GEORGIA

Site-Wide	Groundwater	Soil	Cost
1	A	A	$0
2	B	C	$457,708
3	B	D	$390,723
4	B	E	$549,326
5	C	C	$734,751
6	C	D	$667,766
7	C	E	$826,369
8	D	C	$2,002,204
9	D	D	$1,935,219
10	D	E	$2,093,822

Groundwater Alternatives
A: No Action
B: Institutional Controls
C: Institutional Controls and Containment
D: Institutional Controls, Pumping Wells, On-Site Treatment, and Discharge to POTW

Soil Alternatives
A: No Action
C: Institutional Controls and Containment
D: Excavation and Off-Site Disposal
E: Excavation, Solvent Extraction, and On/Off-site Disposal

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